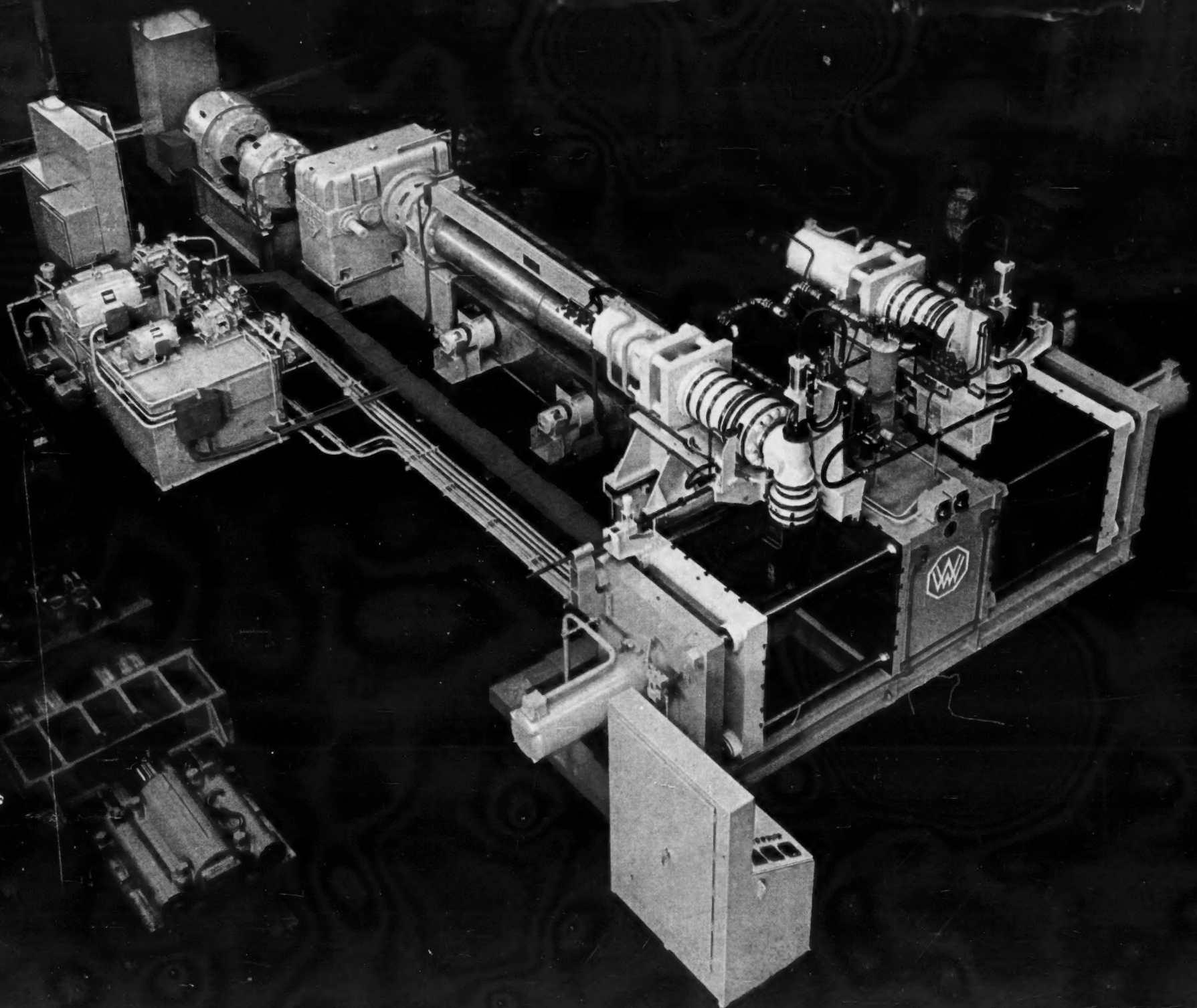


# Design News



A CAHNERS PUBLICATION

JULY 7, 1961

## NEW DEPARTURES IN MINIATURE



### A SIGNIFICANT "BEARING" ON TERRIER GUIDANCE

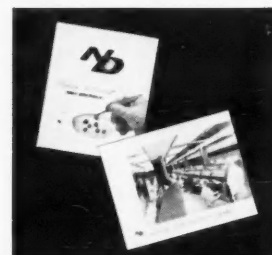
#### N/D MINIATURE AND INSTRUMENT BALL BEARINGS HELP SOLVE COST PROBLEM IN SUPERSONIC MISSILE

**PROBLEM:** Guidance system in Terrier missile required miniature and instrument ball bearings that help reduce high cost of assembly and meet rigid reliability standards.

**SOLUTION:** N/D Sales Engineer, cooperating with the Iron Fireman Manufacturing Company, recommended the use of flanged instrument bearings in the gyro rotor and the outer gimbal positions. Result: Flanged bearings simplified both mountings and resulted in substantial assembly cost savings. Moreover, a N/D miniature ball bearing . . . similar to the bearing pictured between tweezer nibs . . . is used in the gyro caging cam. It also has a vital "bearing" on the Terrier's reliability and performance.

Furthermore, numerous tests in New Departure's R & D facilities proved the bearings to be capable of meeting all environmental demands before gyro production changes were made.

If you would like Miniature/Instrument ball bearing application assistance, please invite the N/D Sales Engineer in your area to participate in your early design discussions. He may point the way to assembly cost savings. Or, call or write New Departure, Division of General Motors Corporation, Bristol, Connecticut.



Send for the New Departure Miniature and Instrument Ball Bearing Catalog and White Room Brochure today. Write to Department L. S.

## NEW DEPARTURE

MINIATURE AND INSTRUMENT BALL BEARINGS

Circle 1 on Reader-Service Card for more information

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# Design News

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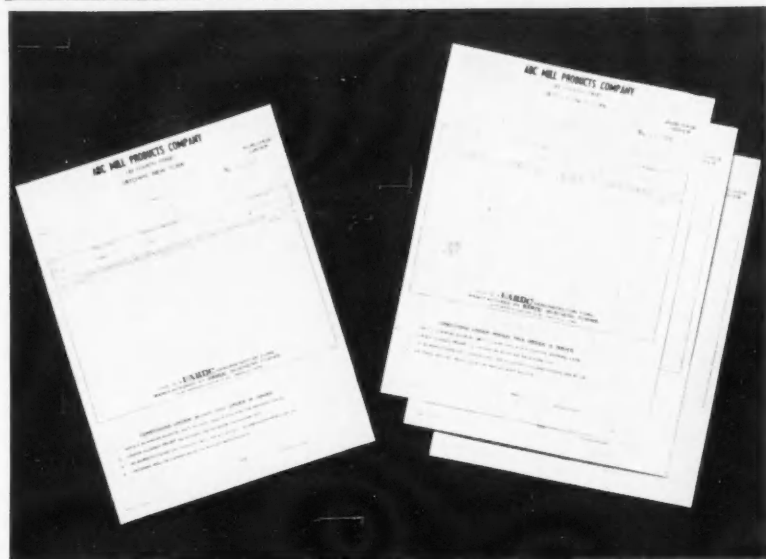
→ **WRITE**



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MINNEAPOLIS 16, MINNESOTA

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# DRAFTING TRENDS



See how little difference can be noted between a nearly opaque original (left) and three fast, economical diazo copies (right) made with POST Super Vapo Black Paper.

## New Super Diazo Papers Make Prints From Prints

### More uses—

No longer limited to copying just thin, translucent originals, recent POST progress in formulating super-fast diazo compounds has added a new dimension to diazotype reproduction.

A selection of new POST direct positive papers can now handle, at reasonable speeds, such problems as making prints from discolored originals, letterhead correspondence, or even from old prints themselves—in short, from subjects considered too opaque for conventional diazo copying.

In drafting rooms, for example, this ability to reproduce from non-translucent originals provides a unique, low-cost way to copy present engineering forms that may be on inexpensive, semi-opaque, sul-white paper.

### More variety—

The convenience and versatility of the whiteprinting process takes on new meaning with these important POST developments. Available in sheets and rolls as Super Veri-Blac (440-14) for semi-moist diazo

equipment, and as Super Vapo Blue (206M-14) and Super Vapo Black (208M-14) for dry, ammonia-process machines.

One of the most impressive features of these POST Super Diazo Papers is the extra speed in reproducing normal subjects, such as engineering tracings. There's no sacrifice of shelf-life, image stability, development rate or clean backgrounds. The printing range is extremely wide.

### More economy—

Cost is a key word in the consideration of any new product. POST Super Diazo Papers cost no more. Further, both large and small users will be quick to note that the combination of speed and economy basic to these new diazotype papers make them practical for longer runs—even 50 copies—and, less expensive than other duplicating methods often selected for such quantities.

Ask your POST dealer or write Frederick Post Company, 3650 North Avondale Avenue, Chicago 18, Illinois, for Super Diazo Facts.



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## SOUNDING BOARD

### FOR OUR READERS



### Reader-Service Cards

... The April 24, 1961 issue was the last one with the new fold-out reader-service cards and index. The May 9, 1961 and subsequent issues have carried the old-style tear-out cards.

There was much correspondence recommending a more convenient system and your magazine indicated that they spent some time in analysis of various means, culminating in the fold-out cards. This was a wonderful change and I believe met with universal reader approval. It had mine, at least.

It is a backward movement to go to the old-style cards and it would seem that you could resume the fold-outs. I wouldn't think there is a need for further analysis. It has already been done recently.

Here's hoping we soon see the fold-outs again.

JOHN W. LOGAN  
Los Angeles, Calif.

• It's a matter of economics.

### Credits

On page 23 in the April 10 issue of DESIGN NEWS there appears a line which is typical of the attitude which has prevented engineers from achieving their proper place in the professional life of our country. I quote "The new pressure gage was designed by Wallace and Tiernan, Inc., Belleville, N. J." ... Look in the learned publications in physics, chemistry, medicine and social sciences, and you will find that advances in these fields are made by individuals who are given credit for their contributions. As long as the "trade" publications (and the key word here is "trade") in engineering give organizations the credit for the work of individual engineers, engineering will be a "tra..." and all the hullabaloo about education, registration, professional attitude and the like will be of no use in raising engineering to its place among the professions.

MORRIS W. LEEN  
Senior Engineer  
The Perkin-Elmer Corp.  
Norwalk, Conn.

• But what about group efforts?

### Automotive Braking

In your June 5 issue, an article on automotive braking states that the locked wheel acts as a fulcrum in a skid.

I had the impression that the *unlocked* wheel acts as a fulcrum because it has greater resistance to transverse forces, as well as greater braking force.

NORMAN R. WILLIAMSEN, JR.  
Westinghouse Bettis Atomic  
Pittsburgh, Pa.

• You're right, we slipped. Our automotive experts are wearing red faces.

### Freedom of the Press

Please accept my deepest gratitude for your wonderful writing about the "Freedom of the Press".

Unfortunately most Americans will not agree with your views, but let us hope that a growing number of us will recognize the threat of Communism (or Russian Imperialism) before—and without—a new Pearl Harbor.

L. O. VARGADY  
Bausch & Lomb, Inc.  
Rochester, N. Y.

### Flow Area Equations

The method of calculating the flow area through an annulus as given by D. J. Lapera in his article, "Flow Area Equations for Rating Poppet-Type Valve Capacity", DESIGN NEWS, January 30, 1961, can be found in engineering references. For years the ASME Boiler and Pressure Vessel Code has used an approximation of the area equation developed in Mr. Lapera's paper to determine the capacity rating of steam safety valves.

Although this approximate method is easy to apply and is understood by engineers, I wish to point out that it should be used with caution for these reasons:

1. The frustum of a cone derivation gives the designer a false concept of the location, size and shape of the minimum or throat area.

2. The area error is on the side of danger. The error may be insignificant for lift ratios (lift divided by bore or seat diameter) less than 0.10 but becomes appreciable at higher lift ratios.

3. Sharp-edged orifice conditions may occur where smooth wall approaches are indicated by the frustum method.

4. Transition position of lift (t) common to two individual area functions are not given accurately by this method.

5. Many commercial safety valve and relief valve designs do not satisfy the requirement:

$d_s = 2t \sin \theta + d_o$ , given incorrectly as  $d_s = t \sin 2\theta + d_o$ . One or two transition positions of lift may occur within the lift range of the poppet.

6. Mathematical relations which limit the maximum lift position re area determination are not evident in the frustum of a cone method.

7. Disparities of flow coefficients between in-flow and out-flow cannot be analyzed successfully on the basis of the equations developed.

Principles of the Calculus of Variations give correct values and location of the flow area, which has the shape of a catenoid. They are more difficult to apply than the frustum method but have none of the objections stated above.

EUGENE K. FALLS, P.E.  
Port Huron, Mich.



## So Johnny Can't Write . . .

A recent country-wide survey of about 450,000 high-school students showed that only one percent could write a five-minute theme without mistakes in English. The National Council of Teachers of English admits that a large proportion of English teachers is unqualified. College freshman courses in "Bonehead English" are the rule rather than the exception.

So what else is new? This might be a natural reaction but hardly one which provides an answer.

The art of writing clear and concise English is not something needed by the few. Rather it is a basic tool we all need. Writing is one means of communication among people. Unless a person learns to write clearly and to the point—and with no obvious grammatical errors—he can expect to remain on the lower rungs.

I have seen numerous instances of writing by graduate engineers which are totally unintelligible and full of errors in spelling, grammar and composition. More than a few of these were on application blanks for various positions. I expect my reaction to these was the same as that of any other person charged with hiring personnel. The applications went promptly into file 13.

Why should it be necessary for large manufacturing concerns to hire technical writers? What is wrong with an educational system that allows an engineer to graduate without the elementary knowledge needed to put his ideas on paper?

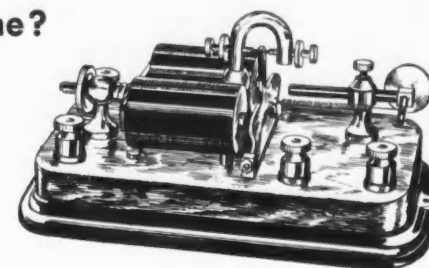
I think the answer lies in our grade schools—not in our high schools or colleges. The art of writing clearly and correctly is so fundamental that it should be a prerequisite to graduation at all levels. Why, for instance, should the college be forced to accept freshman students who do not have this basic tool at their command? Remedial English in college is certainly not the answer. And for that matter, why should high schools graduate people who are incapable of putting three or four sentences together?

It seems to me that the only logical answer to this disgraceful problem lies in more reading and more writing in the lower grades. Personally, I would much rather have my kids learn how to read and write than to learn how to sell PTA tickets. The teachers in our schools cannot do it alone. Home training is the real answer. What are you doing to help your children read and write?



Executive Editor

where  
have the  
simple relays  
gone?



Many, of course, have disappeared along with the relatively simple jobs they were asked to perform. (A good telegraph relay\* or pulse repeater today, for example, should not only be small but able to transfer its contacts on a milliwatt or so about 500 times a second for half a billion operations—and then be repairable, adjustable and lovable besides.) But there are still plenty of naive, uncomplicated loads around that ask only to be switched on and off, at reasonable intervals, by a device that doesn't have so many parts and fancy thingamajigs that it may become temperamental and refuse to work without being coaxed.

For such applications we are happy to say we have a paragon of ingeniously simple, fool-proof relay design. It won't make the same confidence-inspiring noise as the classic above and it's not for telegraphy, but you can see through its enclosure and watch its contacts surely open and close. The designer started with the familiar enclosure and octal plug-in base and then developed the relay accordingly (with UL requirements in mind); he didn't

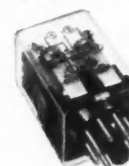
\*Plug (octal, that is) for Sigma Series 72 relay



just take an existing relay and tack on a new base and enclosure. As a result, the parts make the best use of the volume (1 5/16" square x 2 1/16" high) and are big, simple, rugged and few in number. The base is specifically designed to carry the 10 amp. loads the relay will switch.

The relay is designated "Series 46" and intended for general purpose, heavy-duty DPDT switching on AC or DC inputs. Rated DC loads are 5 amps at 28 volts, 1 amp. at 120 volts; AC, 1200 volt-amperes per pole with 240-volt and 10-amp. maximums. Life ranges from 10 million operations with 1-amp. loads to half a million with 10-amp. loads. The relay can be as sensitive as 200 milliwatts DC, or 0.2 v-a AC.

We've looked at what else is available for the same modest price and the "46" specs give us considerable hope. If your problem has been the right specs but the wrong price, or vice-versa, perhaps you'd like the 46 AC and DC bulletins. In the meantime, always remember: You can be sure if it's Sigma, it's simple.



# SIGMA

SIGMA INSTRUMENTS, INC.  
53 PEARL ST., SO. BRAINTREE 85, MASS.

Circle 4 on Reader-Service Card for more information

## Analog Computer Solves Mechanism Problem on Tape Transport Recorder

Edward W. Schrader, Western Editor

An analog computer encourages the engineer to depend more on analysis and less on empiricism (cut and try) in his design work. It also encourages the engineer to fully instrument the device for testing after it is built. This leads to a more complete knowledge of how the mechanism actually operates.

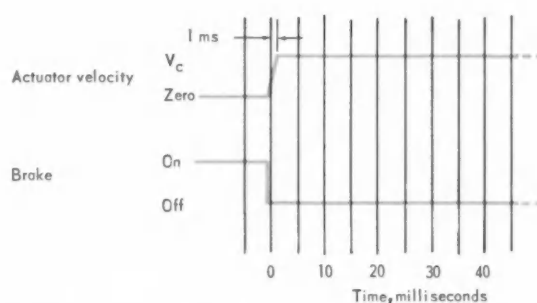
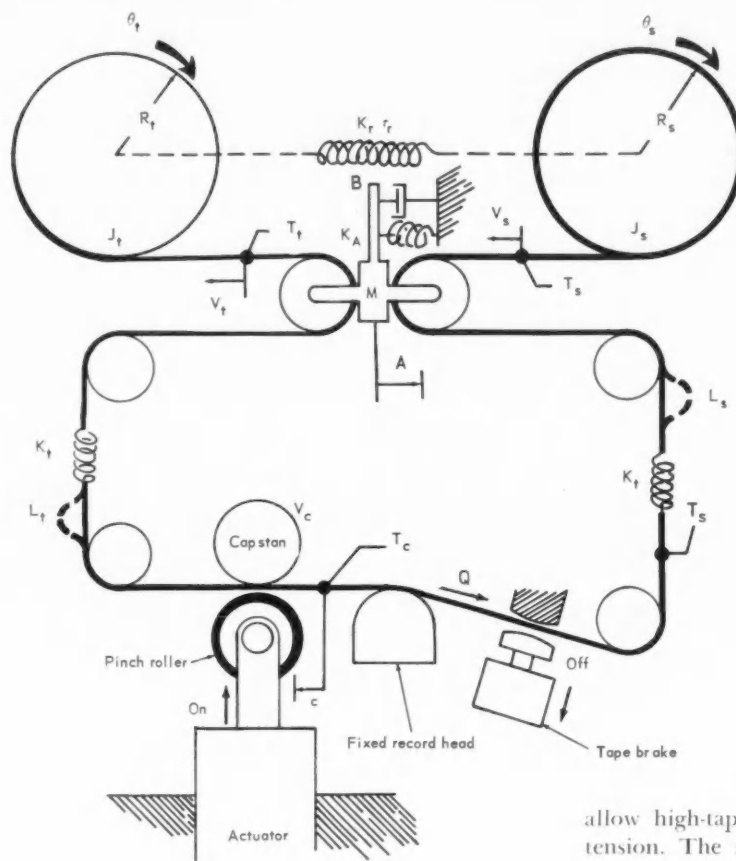
In an analog computer, mathematical operations are performed by building block components: operational amplifiers, potentiometers, function generators, multipliers and passive electrical networks. A central patch bay connects the functional units. Potentiometers set coefficients.

In this application, the transport mechanism of the Ampex AR 400 Recorder was simulated on a Donner Scientific Model 3100 Analog Computer. Analysis started with a mechanical schematic of the mechanism. Equations of motions were written. The problem was set up according to block diagrams which simulated the equations of motion. Computer time was scaled to magnify real time by 100, permitting the recording of solutions on an available strip-chart recorder. Results of the computer solutions were compared with the actual machine.

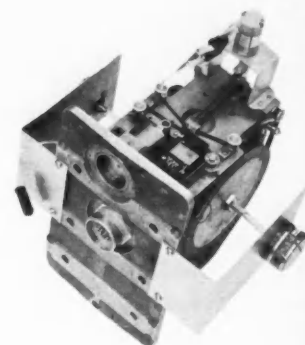
### Mechanism Analyzed

A torsion spring couples two tape reels. Since the radius of the reel hub is large in comparison to the outside tape radius for a full reel, the reel-turn differential in transferring the tape from one reel to another is small. The torsion spring absorbs this differential and maintains tension in the tape system. The energy stored in the spring accelerates the take-up reel in removing the tape supplied by the capstan. Initially the spring is wound to a maximum with one reel full and the other empty. The number of turns lost in removing the reel differential reaches a maximum at the mid-reel position. When the transfer is completed, the spring is rewound to a maximum. The system returns to the full-empty reel condition.

A capstan and pinch roller drive the tape from one reel to the other. When the pinch roller is actuated, an approximate step function change in tape velocity results. A "shock-loop arm," normally spring-loaded to center, allows fast acceleration of the tape. It keeps the tension force in the tape within the friction drive limit of the pinch roller. The arm is used because the supply reel inertia does not



**WAVE FORM OF STEP INPUT MODE.** Brake moves from "on" to "off" position immediately. Actuator velocity moves from 0 to maximum value in one millisecond.



**MECHANISM FOR TAPE TRANSPORT SYSTEM.** With actuator energized, pinch roller provides friction force against rotating capstan to move tape from supply reel on right to take-up reel on left. Brake releases simultaneously. Arm moves to right for distance A, to prevent excessive tape tension  $T_s$  as tape accelerates and to consume slack loop  $L_s$ .

allow high-tape acceleration with reasonable tape tension. The arm also removes the take-up loop, allowing greater time for the take-up reel to accelerate without spilling of the tape.

A brake stops tape motion when the pinch roller is disengaged.

When the actuator brake system is de-energized, the pinch roller immediately drops out, and the brake engages three millisecond later, causing the tape to stop. A coasting period of three millisecond is therefore available.

### Desired Solutions

Two modes of operation were investigated: Step input and programmed input.

For each of these modes, three reel conditions were investigated. They were:

- Condition 1. Full supply reel, empty take-up reel.
- Condition 2. Empty supply reel, full take-up reel.
- Condition 3. Both reels half full.



**MECHANISM OF TAPE TRANSPORT** with test instrumentation. Synchro-control transmitter is mounted on shock-loop arm and energized with 400-cps power. Continuous-rotation potentiometers are mounted on each reel and energized with 3v d-c.



**ANALOG COMPUTER** used for simulation of mechanism design problem. Patch board for wiring problem is at upper right of control panel. Fifteen potentiometers set initial conditions. Three-position lever switches allow selection of amplifier mode of operation for initial conditions.

For actual design purposes, eight values were required as a function of time, for each of the six combinations of operating mode and reel condition.

For simplicity, consider only the condition with actuator on, brake off and step input. The following 11 equations completely determine the 11 unknown variables:  $A, c, L_s, L_t, T_c, T_s, T_t, V_s, V_t, \theta_s, \theta_t$ .

$$T_c = T_s + \frac{Q(T_c + T_t)}{2} = T_s + \frac{QT_c + QT_s}{2}$$

$$T_c \left(1 - \frac{Q}{2}\right) = T_s \left(1 + \frac{Q}{2}\right)$$

$$1 \quad T_c = T_s \frac{2+Q}{2-Q} \quad \text{Condition } Q = 0.1$$

$$2 \quad (a) \quad 2(T_s - T_t) = M\ddot{A} + B\dot{A} + K_A A \quad \text{when } L_s \leq 0 \text{ and } L_t \leq 0$$

$$2 \quad (b) \quad 2T_s = M\ddot{A} + B\dot{A} + K_A A \quad \text{when } L_t > 0 \text{ and } L_s \leq 0$$

$$2 \quad (c) \quad -2T_t = M\ddot{A} + B\dot{A} + K_A A \quad \text{when } L_s > 0 \text{ and } L_t \leq 0$$

$$2 \quad (d) \quad 0 = M\ddot{A} + B\dot{A} + K_A A \quad \text{when } L_s > 0 \text{ and } L_t > 0$$

$$3 \quad (a) \quad J_s \ddot{\theta}_s = T_s R_s - [\tau_r + (\theta_s - \theta_t) K_r] \quad \text{when } L_s \leq 0$$

$$3 \quad (b) \quad J_s \ddot{\theta}_s = -[\tau_r + (\theta_s - \theta_t) K_r] \quad \text{when } L_s > 0$$

$$4 \quad V_s = R_s \dot{\theta}_s$$

$$5 \quad V_t = R_t \dot{\theta}_t$$

$$6 \quad (a) \quad J_t \ddot{\theta}_t = [\tau_r + (\theta_s - \theta_t) K_r] - T_t R_t \quad \text{when } L_t \leq 0$$

$$6 \quad (b) \quad J_t \ddot{\theta}_t = [\tau_r + (\theta_s - \theta_t) K_r] \quad \text{when } L_t > 0$$

$$7 \quad c = \int_0^t V_c dt$$

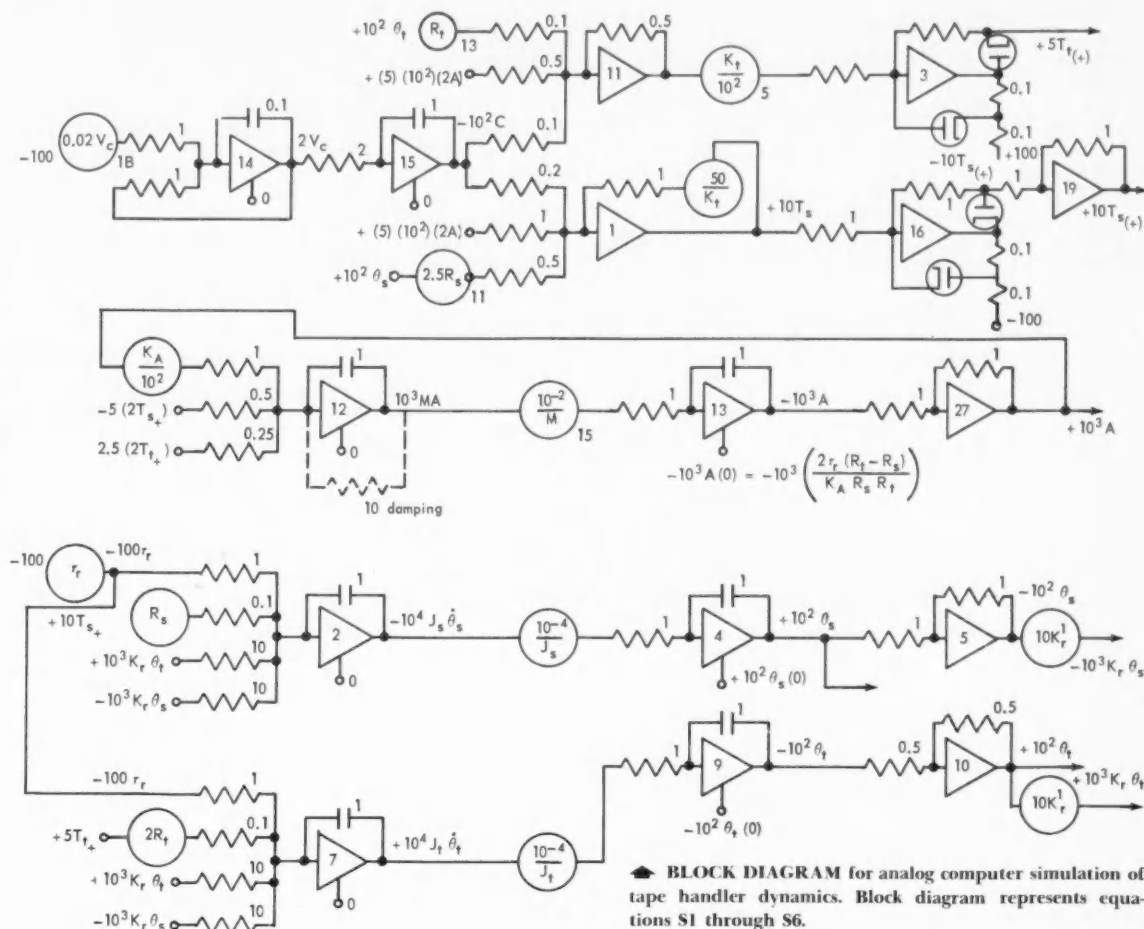
$$8 \quad L_s = R_s \theta_s + 2A - c \quad \text{when } L_s > 0$$

$$9 \quad L_t = c - 2A - R_t \theta_t \quad \text{when } L_t > 0$$

$$10 \quad T_s = K_t (c - 2A - R_s \theta_s) \quad \text{when } L_s \leq 0$$

$$11 \quad T_t = K_t (R_t \theta_t + 2A - c) \quad \text{when } L_t \leq 0$$

(Continued on next page)

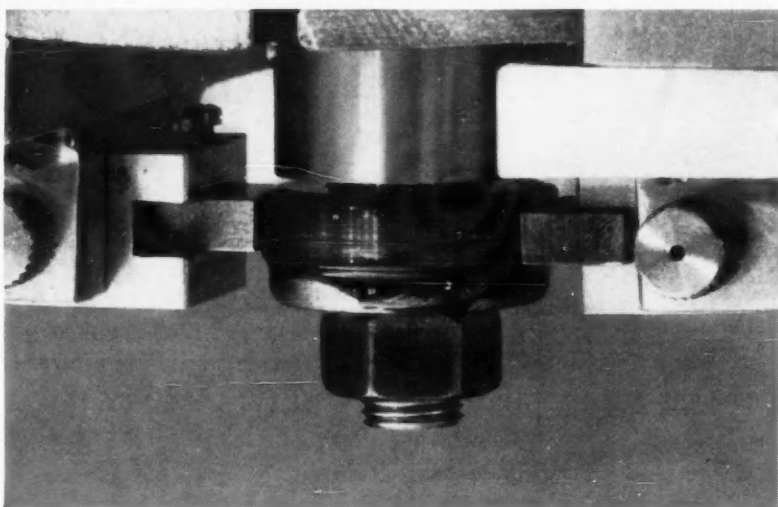
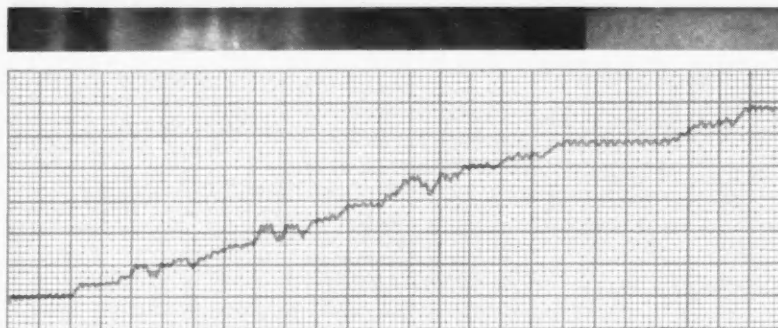


SYMBOLS	UNITS	MULTI-VALUED REEL CONDITIONS		
		1	2	3
A	Distance traveled by the shock-loop arm	ft		
B	Damping constant of shock-loop arm	0.046 lb-sec/ft		
c	Tape motion at the point indicated in Fig. 1	ft		
J <sub>s</sub>	Inertia of the supply reel	slug-ft <sup>2</sup>	(5.26) (10 <sup>-4</sup> )	(4.33) (10 <sup>-4</sup> )
J <sub>t</sub>	Inertia of the take-up reel	slug-ft <sup>2</sup>	(3.53) (10 <sup>-4</sup> )	(5.26) (10 <sup>-4</sup> )
K <sub>A</sub>	Spring constant of the shock-loop arm	15 lb/ft		
K <sub>r</sub>	Spring constant of the reel spring	(2.1) (10 <sup>-3</sup> ) lb-ft/radius		
K <sub>t</sub>	Spring constant of the tape, supply or take-up side	72 lb/ft		
L <sub>s</sub>	Tape loop on supply reel side	ft		
L <sub>t</sub>	Tape loop on take-up reel side	ft		
M	Mass of shock-loop arm	(7.75) (10 <sup>-3</sup> ) slug		
Q	Dynamic friction coefficient	0.1 (brake released)		
R <sub>s</sub>	Radius of supply reel tape pack	ft	0.247	0.208
R <sub>t</sub>	Radius of take-up reel tape pack	ft	0.208	0.247
T <sub>c</sub>	Tape tension between the capstan and record head	lb		
T <sub>s</sub>	Tape tension on the supply reel side	lb		
T <sub>t</sub>	Tape tension on the take-up reel side	lb		
V <sub>c</sub>	Capstan surface velocity	2.5 ft/sec		
V <sub>s</sub>	Tangential velocity of the supply reel tape pack	ft/sec		
V <sub>t</sub>	Tangential velocity of the take-up reel tape pack	ft/sec		
θ <sub>s</sub>	Angular change, supply reel	radius		
θ <sub>t</sub>	Angular change, take-up reel	radius		
r <sub>r</sub>	Initial torque in the reel spring	lb-ft	0.221	0.221
			0.097	

Color indicates design items required as function of time for solution.

Gray indicates fixed parameters.

# WE TAKE THE PULSE OF BEARINGS ON TAPE TO MAKE THEM EVEN BETTER!

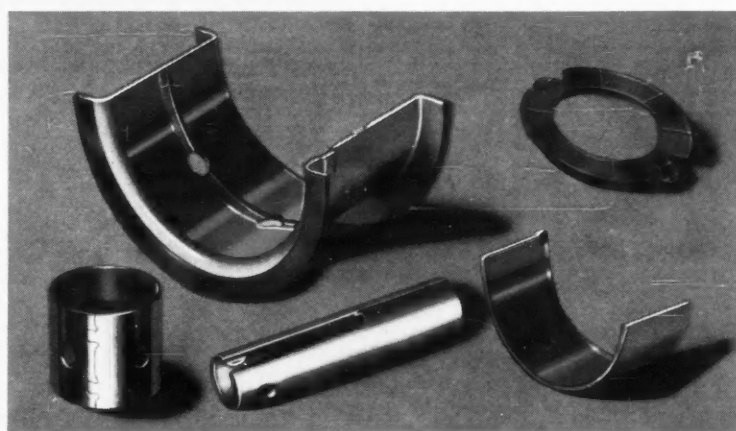


## TO TAPE-RECORD THE "HEARTBEAT" OF BEARING METALS UNDER LOAD, WE USE THIS SPECIAL FRICTION AND WEAR TESTER.

(left) The result is highly accurate data on the behavior of bearing-metal surfaces, invaluable in our fundamental research into friction. By means of this instrument, we're able to correlate, more closely than ever before, specific alloy compositions with their degree of the "stick-slip" phenomenon (in which one surface sliding over another slides . . . stops . . . slides . . . stops . . . and so on) which accompanies unlubricated sliding action. We can also determine accurately the compatibility of bearing materials with shaft metals in lubricated systems . . . showing us which metal or alloy is most likely to be superior for a given bearing application. In short, this Friction Tester is a fundamental research tool which gives us positive answers to difficult bearing problems, faster than ever before.

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There's much valuable data in our Design Guides on sleeve bearings, thrust washers, and bushings; and in our brochure on spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

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## Computer Solution

The computer was set up as shown in the block diagram. A reduced system of equations was used in which the variables  $T_c$ ,  $V_s$ ,  $V_t$  do not appear. These were readily derived by multiplying  $T_s$ ,  $\theta_s$ , and  $\theta_t$ , respectively, by a suitable constant (see equations 1, 4 and 5). The simulation equations are numbered S1, S2, etc.

## Equations:

$$S1. \ddot{M}A = -\ddot{B}A - K_A A + 2(T_s - T_t) T_s \geq 0, T_t \geq 0$$

$$S2. J_s \ddot{\theta}_s = T_s R_s - [\tau_r + (\theta_s - \theta_t) K_r] T_s \geq 0$$

$$S3. J_t \ddot{\theta}_t = T_t R_t + [\tau_r + (\theta_s - \theta_t) K_r] T_t \geq 0$$

$$S4. c = \int_0^t V_c dt$$

$$S5. L_s = R_s \theta_s + 2A - c \quad L_s > 0$$

$$S6. L_t = c - 2A - R_t \theta_t \quad L_t > 0$$

## Input:

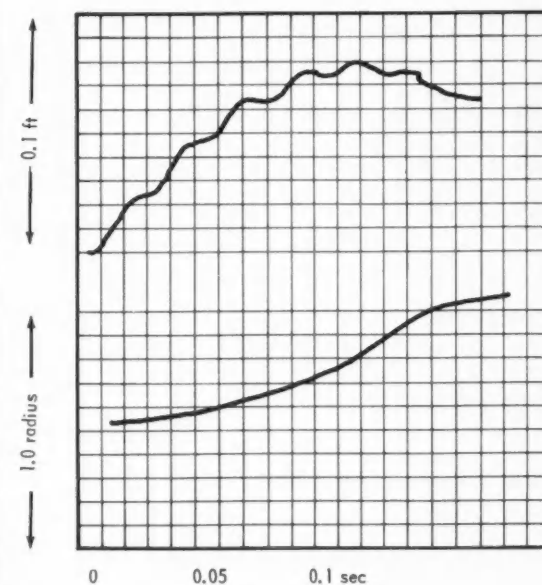
$$V_c = \frac{2.5}{1 + 0.001s} \text{ (transform)}$$

## Initial Conditions:

$$-10^3 \theta_t(0) = -10^3 \frac{\tau_r}{R_t^2} \left[ \frac{1 - 4(R_t - R_s)}{K_t} \right]$$

$$+10^3 \theta_s(0) = -10^3 \frac{\tau_r}{R_s^2} \left[ \frac{1 + 4(R_t - R_s)}{K_t} \right]$$

The one-millisecond rise time of tape velocity at the capstan was simulated by exponential rise of one-millisecond time constant. The latter was easier to simulate on the computer and the computer solutions of the two systems were indistinguishable.



COMPUTER SOLUTION on chart paper for step input with actuator on brake off. Upper curve represents arm motion (A) of 0.08 ft in 0.11 sec. Lower curve shows take-up reel reel angle ( $\theta_t$ ) of 0.54 radians at 0.11 sec.





**OSCILLOSCOPE TRACE** of actual transport behavior for same condition as computer solution. At 0.11 sec, reel of actual recorder has turned through smaller angle than that of simulated machine. Recorder arm has moved greater distance than simulated arm. Difference may be noted by observing two reel displacement traces. Simulation reel begins to move at  $t = 0$ , while recorder reel is stationary for about 40 milli-sec. Friction at reel probably accounts for discrepancy. This factor also could have been added to computer setup.

#### Computer Solution Compared with Actual Results

The oscillation superimposed on the shock-loop arm motion in the computer solution is absent from the actual mechanism. Natural frequency of the subsystem is about 44 cps. The subsystem is composed of the shock-loop arm, its spring and the two lengths of tape. The neglected inertias of the small idlers and the coulomb friction in various bearings could easily account for the absence. Analog computer simulations could have been refined to include these effects or their equivalent.

A direct comparison of results shows a fair correspondence between the computer solution and the actual mechanism except for the above-mentioned oscillation.

#### Conclusions

An analog computer can produce results which match the performance of the real device with sufficient accuracy for most engineering work. Equations describing the performance of a mechanism generally may be written by any graduate engineer. The resulting system of equations is not soluble in a reasonable length of time except in trivial cases. The equations may be set up on the computer in less than a day. The computer may be set to produce solutions in real time, "slow-motion" or "speeded-up", as desired. Each variable in the simulation may be read against time or against any other variable.

*Technical information for this special report was provided by: B. M. Brenner, Staff Engineer, Product Development, Ampex Corp., Redwood City, Calif., and Beverly Paxson Taskett, Computer Applications Engineer, Donner Scientific Co., Concord, Calif.*

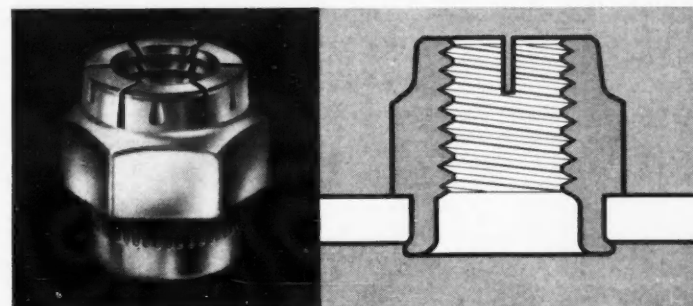
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### FLEXLOC Self-Locking Clinch Nuts

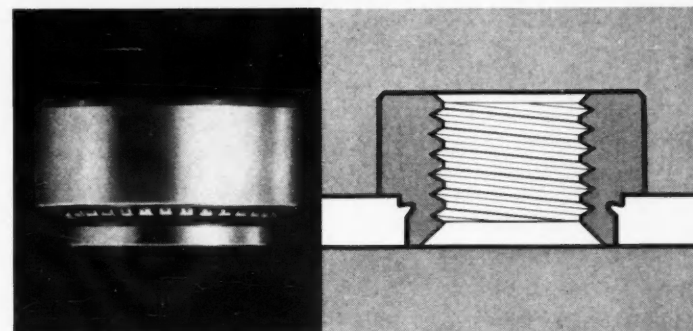
Designed for thin-section materials up to Rockwell C20 hardness. Incorporating the time-proven FLEXLOC self-locking feature, they are specially valuable where equipment must be disassembled periodically. Installed by roll-over clinch method with SPS punch and dolly tips.\* Sizes #4 through  $\frac{3}{16}$  inch in cadmium-plated steel (serviceable to 550°F), stainless steel (to 800°F), brass and aluminum (to 250°F). Also microsizes—#0 to #4—in same materials. Locking torque and vibration requirements meet or exceed MIL-N-25027.

\*Recommended installation tools available as standard products. Dolly tips for flush mounted clinch nuts also available.



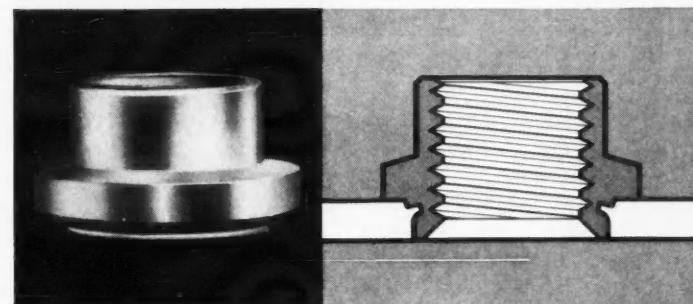
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The simple, economical solution to the problem of getting sufficient load-bearing threads in thin material. Installed from one side—they mount flush—without use of special tools and without distortion or discoloration of parts. Suitable for materials to Rockwell C25 (this includes mild steels). Good torque-out and push-out values assured by positive displacement of metal into retaining groove. Sizes #2 through  $\frac{1}{2}$  inch in cadmium-plated steel. Serviceable to 550°F.



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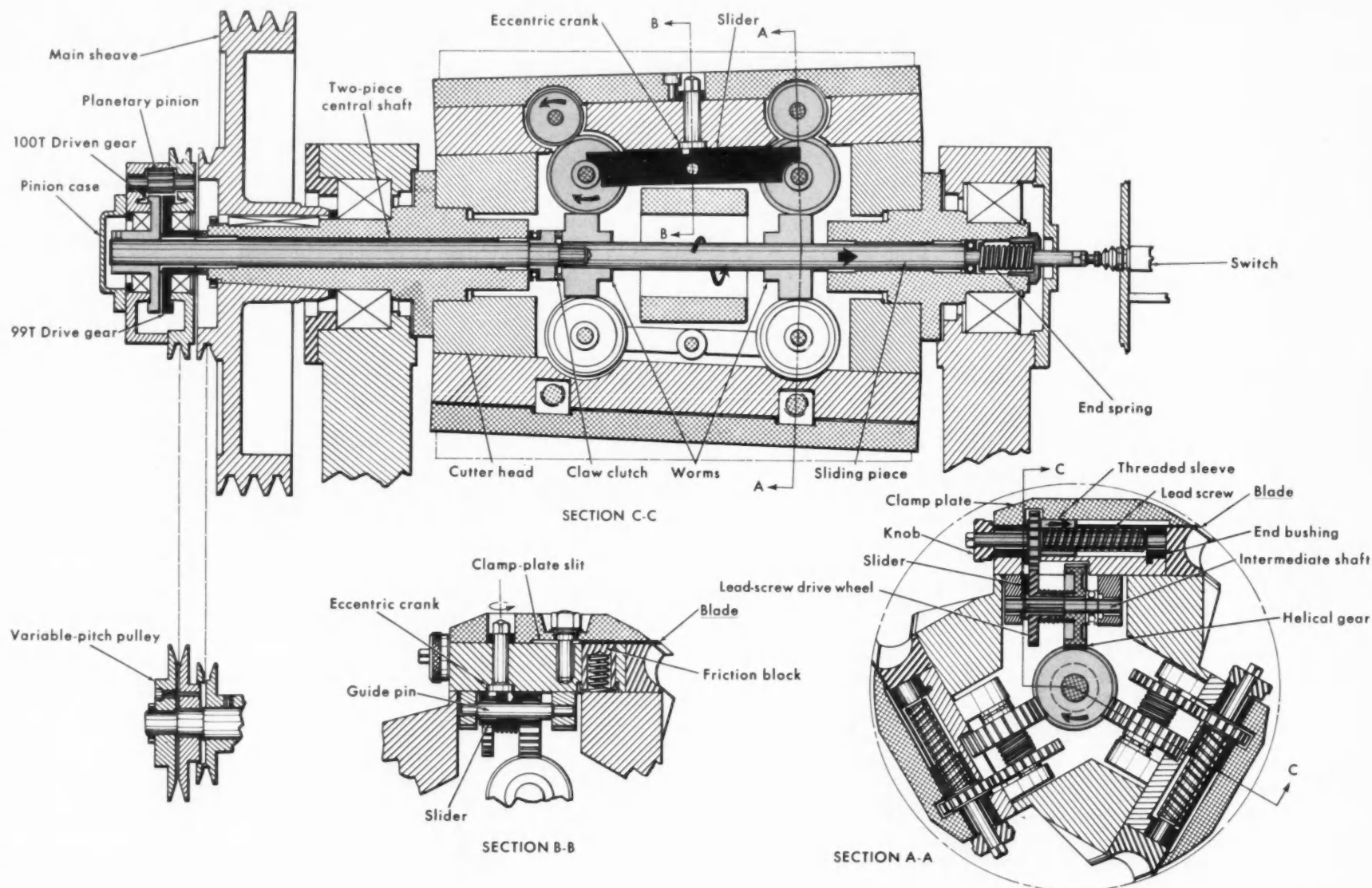
# SPS

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## Unequal Sun Wheels Control Slow Feed of Cutting Blades

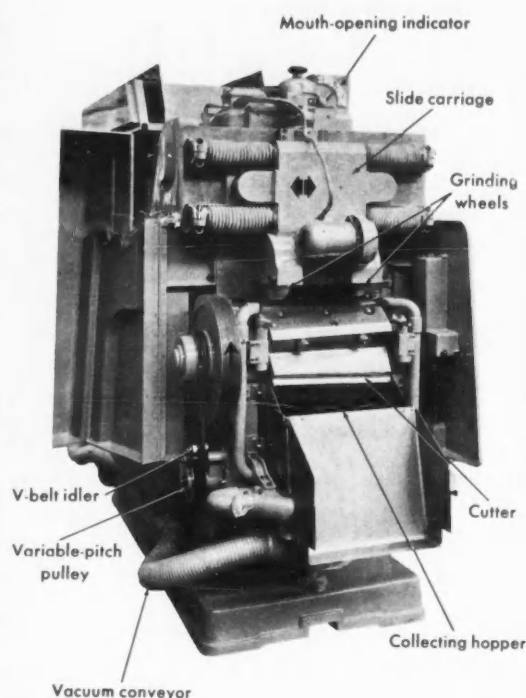
Celestino O. Lubatti, Italian Editor



PLANETARY PINION (20 teeth) revolves with varying speed about constant-speed drive gear (99 teeth) and transfers motion to driven gear (100 teeth). Main sheave and drive gear are keyed to cutter head rotating with constant speed of 454 rpm. Planetary pinion case is driven by main sheave via variable-pitch pulley permitting 504 to 579 rpm. Resulting speed of central shaft is infinitely variable within 454.5 to 455.25 rpm. Claw clutch connects axial pieces forming cen-

tral shaft and transfers slow differential motion to two worms. These rotate six intermediate shafts (three for each worm) driving blade-control lead screws. Threaded sleeves on lead screws thrust blades outward against grinding wheels (not shown) for resharpening. Jutting rate is established by variable-pitch pulley to maintain satisfactory cutting efficiency with minimum blade wear. When one or more blades are worn down to minimum width, threaded sleeve contacts end

bushing of lead screw and stops gear train. Rotating worm relative to worn-out blade thrusts sliding part of central shaft against miniature switch for automatic motor cutoff and claw-clutch release. End spring produces clutching pressure. Pin-guided slider is shifted inwardly by eccentric crank to throw lead-screw drive wheels out of engagement. Knobs on lead screws permit manual retraction of threaded sleeves for blade replacement and/or adjustment.



A variable-speed planetary pinion meshes simultaneously with two sun gears of equal diameter but different by one tooth. The epicyclic train permits exceptional speed reduction without complexity of the driving system. Adjustable revolving motion of the planetary pinion varies the differential speed within 0.5 to 1.25 rpm. The infinitely variable drive performs gradual expansion of blades in a tobacco cutter for automatic resharping of cutting edges.

Negligible difference in circular pitch, caused by unequal number of teeth of the sun gear, allows meshing of planetary spur pinion without compromising efficiency. The 99-tooth driving gear is keyed to the rotating cutter head; the 100-tooth driven gear is on a central shaft actuating the planetary pinion case with an adjustable speed which is always higher than the drive gear speed. The resulting relative motion causes rotation of pinion about its axis and differential motion of driven gear.

Worms on the central shaft rotate helical gears, providing additional speed reduction. Lead screws expand blades against grinding wheels with a variable rate of 1.18 to 2.95 mm (0.0465 to 0.116 inch) per hour. Combined action of centrifugal force and friction blocks holds blades within clamp-plate slits. Pin-guided slider releases lead screws for manual reset or replacement of blades. Adjustable opening of feed mouth varies feed cut thickness. The machine is produced by S.A.S.I.B., Scipione Innocenti SpA, Bologna, Italy.

## MIL-R-19365C Across the Board!



## OHMITE "Dividohm" Adjustable Resistors

**HIGHLIGHTS OF MIL-R-19365C**—This revised specification covers power-type, wire-wound, adjustable resistors from 1 to 15,000 ohms inclusive. Resistance tolerance is specified as  $\pm 5\%$  for all eight power ratings which are listed at right. The maximum continuous operating temperature is 350°C (Char. V).

MIL-R-19365C resistors are the tubular type with single-layer windings and lug-type terminals—two fixed and one adjustable.

Ohmite can supply all eight adjustable resistors to meet every requirement of MIL-R-19365C. Higher resistances using smaller wire sizes are available, also, to meet the performance requirements of this new MIL specification.

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### STANDARD MIL-R-19365C ADJUSTABLE RESISTORS

STYLE	WATTS	DIMENSIONS		OHMS	
		LENGTH	DIA.	MIN.	MAX.*
RX29	11	1¼"	7/16"	1	470
RX32	17	2"	9/16"	1	910
RX33	26	3"	5/8"	1	1,500
RX35	55	4"	7/8"	1	3,600
RX36	78	4"	1½"	1	5,100
RX37	113	6"	1½"	1	8,200
RX38	159	8"	1½"	1	11,000
RX47	210	10½"	1½"	1	15,000

\*0.004" Diameter wire.

Offering you complete availability of these MIL resistors so quickly is another indication of Ohmite's ability and desire to give industry the finest, most advanced resistance products with the best of service.

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## Ed Schrader

(B.S. — M.E., University of California)

### covers

- California
- Oregon
- Washington
- Idaho
- Nevada
- Utah
- Arizona



Before digging out story details, Schrader gathers important background information.

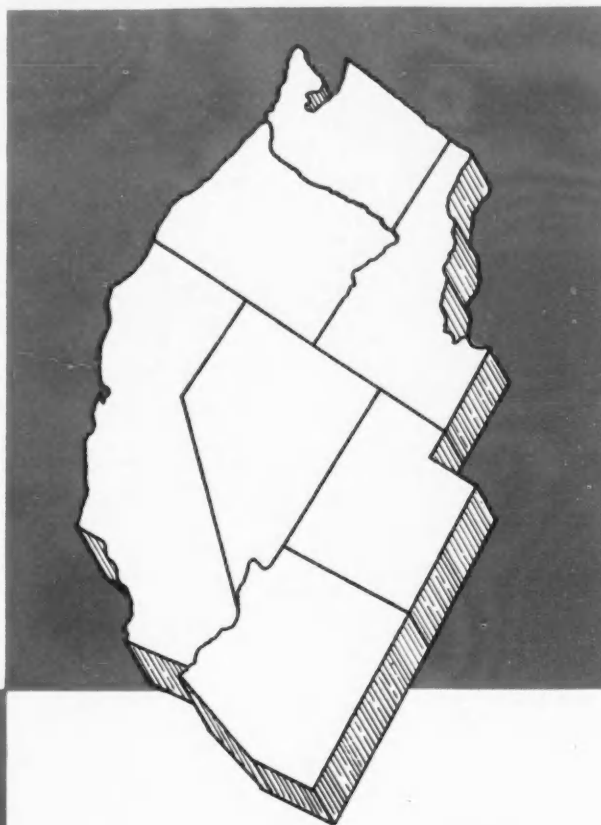
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Of course, many of his leads come by phone or letter from men like yourself. These he follows up in person.

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He'll be glad to discuss a possible article with you.



## for Design News



Engineer-editor Schrader gets the heart of Design Idea with men who made the news.

## IDEAS...MECHANICAL

### Grooved Ceramic Ring

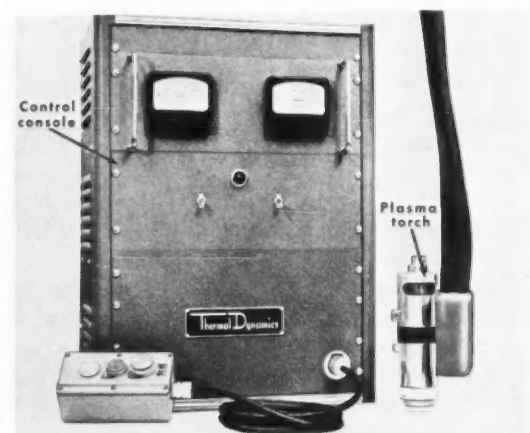
Victor W. Wigotsky, Eastern Editor

A grooved ceramic ring provides gas sheath stabilization in a plasma cutter. The ring causes the gas to form a vortex which constricts and guides a high-power arc across a 2-inch gap. Design converts a relatively diffuse plasma jet into a precise cutting torch.

Normally, plasma torches, for operations other than cutting, use a nontransferred arc which strikes from negative electrode to positive nozzle. In the cutter, the arc is transferred from the electrode to the positive workpiece.

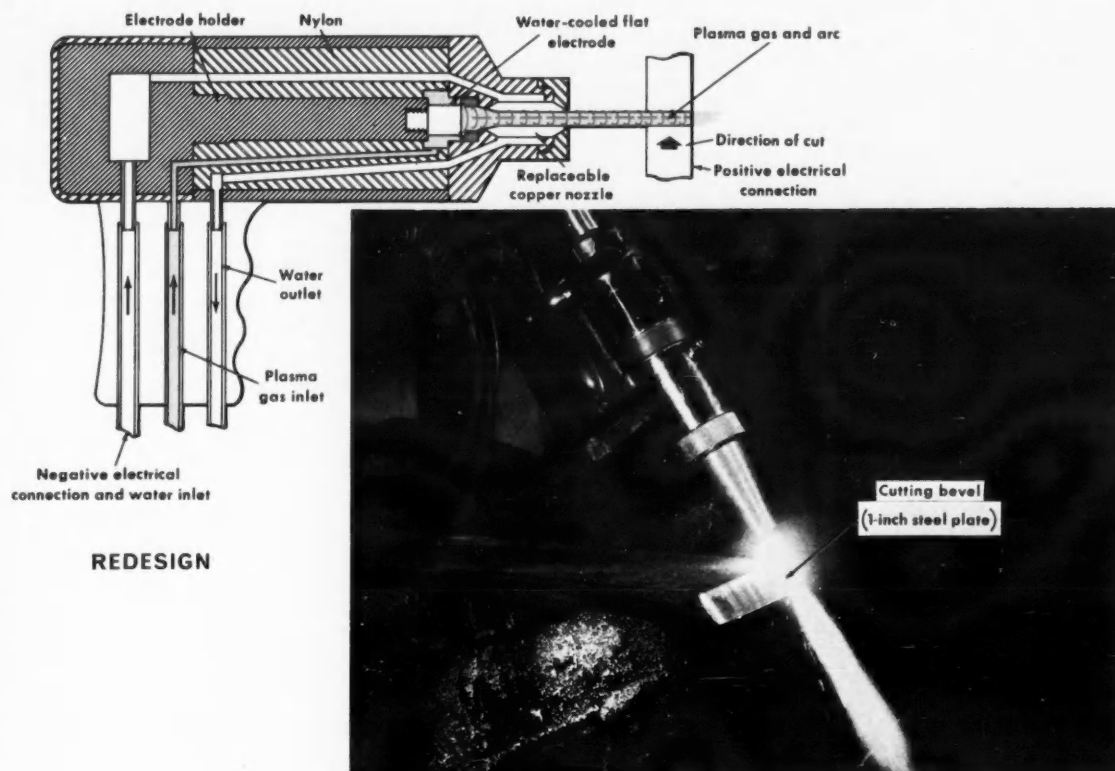
Gas sheath stabilization provides precise control of arc transfer to assure its proper direction through the torch orifice. Mixtures of nitrogen-hydrogen or argon-hydrogen are fed into the arc region through the grooved ring. The ring causes the gas to swirl and surround the arc so that it centers on the flat electrode. Leaving the torch at high velocity, the plasma stream continues to remain constricted until it strikes the workpiece, thus producing a narrow kerf or cut.

The new plasma flame cutter is designed and manufactured by Thermal Dynamics Corp., Lebanon, N.H.



PLASMA FLAME SYSTEM is integrated package. Control console automatically regulates power, gas and cooling water. Pushbutton starting and stopping of torch and torch motion device are operated through remote-control switches. Electric power is supplied from d-c rectifier power sources through water-cooled leads, which also provide cooling for torch, electrode and cutting tips. Straight-line, shape, stack and bevel cutting, as well as piercing, can be done with unit.

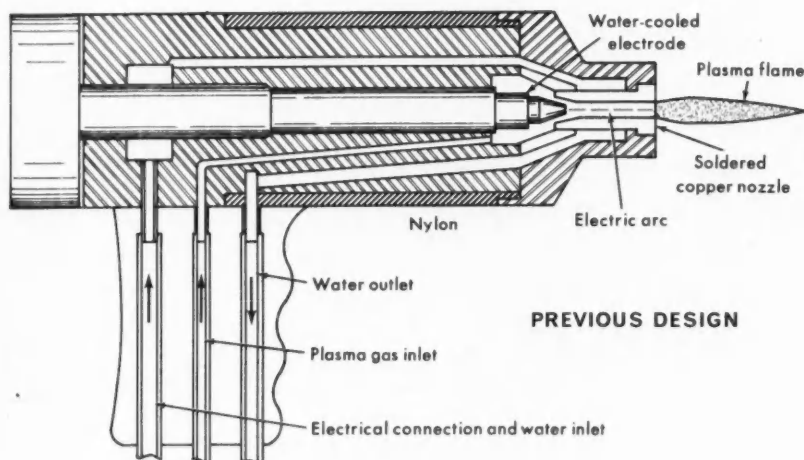
## Stabilizes Plasma Cutter's Arc



REDESIGN

REDESIGN uses grooved ceramic ring and flat electrode (patent pending). Swirling gas produces low pressure core. Positioning is accomplished aerodynamically with resulting vortex which automatically centers arc in middle of nozzle and eliminates precise centering tolerances. Water-cooled, consumable copper nozzles are O-ring-sealed for easy replace-

ment. High current density d-c arc, constricted and stabilized by gas sheath, strikes from electrode tip to workpiece. Plasma gas and arc then strike workpiece and transfer high-intensity heat (up to 60,000F) for rapid cutting. Gas velocity washes away molten metal.



PREVIOUS DESIGN

NONTRANSFERRED ARC, in previous design, normally is used in plasma flame torches for spraying, heating and other applications. Arc then is contained within torch and strikes from electrode to cooled nozzle. Pointed electrode must be centered precisely to avoid concentrated arc spot and rapid nozzle ablation. Axial position of electrode is critical to prevent short, concentrated arc at low gas flows used.



PLAIN TYPES

### CHARACTERISTICS

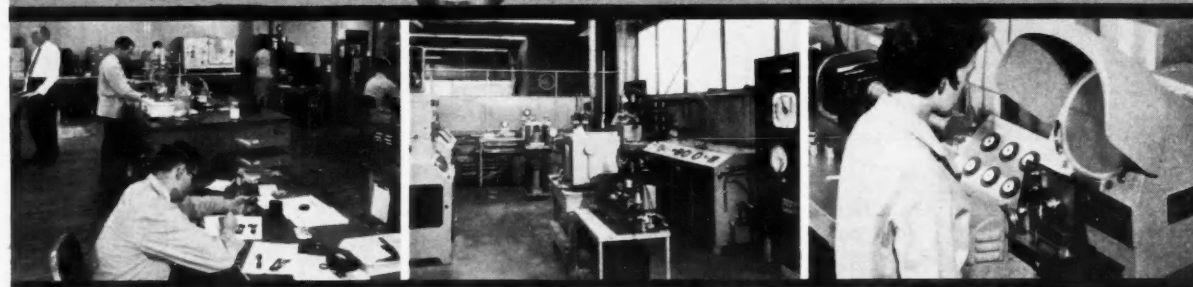
ANALYSIS	RECOMMENDED USE
1 Stainless Steel Ball and Race	{ For types operating under high temperature (800-1200 degrees F.).
2 Chrome Alloy Steel Ball and Race	{ For types operating under high radial ultimate loads (3000-893,000 lbs.).
3 Bronze Race and Chrome Steel Ball	{ For types operating under normal loads with minimum friction requirements.
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### IDEAS...MECHANICAL

## Toggle-Action Conveyors

E. J. Stefanides, Central States Editor

A farm implement for spreading pelleted and granular fertilizer is designed with vibrating hopper bottoms for conveying material to the valve ports. Vibrating hopper bottoms assure a constant flow of material through the ports and prevent packing or caking of the material in the hopper.

Two vibrating bottoms or shaker pans are used, one for each of the valve ports which control the flow of material. They are located in the bottom of the hopper on either side of a partial partition at the center of the hopper bottom.

Wide-swath spreading of the fertilizer material is achieved by two power-driven, centrifugal-action spreader fans, gravity-fed by two large valve ports. These fans cast the material in overlapping semicircles behind the machine.

One of the problems in a machine of this type is maintaining an effective supply of material over the valve ports, particularly when the hopper supply is running low. The problem is solved by two mechanically driven shaker pans which convey the material from the center of the hopper and heap it above the valve ports. Shaker-pan mechanisms are driven off the drive shaft which transmits PTO power to the spreader fans.

A toggle-mechanism is driven from a crank pin on the shaft with a long radius centering link, which restricts motion of the toggle pin. This arrangement provides two complete cycles of the shaker pans for each revolution of the drive shaft since a feed-stroke takes place each time the toggle goes over center. The hopper or shaker pans consist of hanger-mounted, neoprene-covered plates which are joined to the sloping sides of the hopper by a neoprene gasket cemented in place around the perimeter of the plate. To assure precise functioning, simple adjustments are provided for varying the length of the drive arm, the relative length of the shaker arm links and the location of the center about which the centering link rotates.

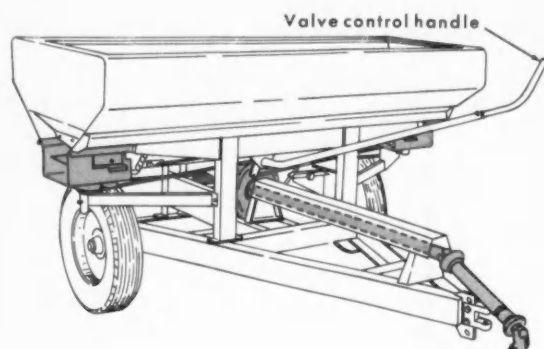
Other adjustments are provided on the spreader itself to control the rate and actual placement of the material. These include a plate which varies the effective port size of the valves, and a radial adjustment of the hopper discharge into the fan.

The Brod-Kastor fertilizer spreader is designed and manufactured by Belt Corp., Orient, Ohio.

DESIGN NEWS—JULY 7, 1961



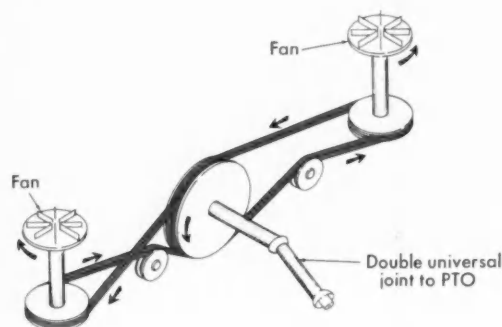
## Provide Improved Flow in Spreader



**VIEW OF UNIT** from PTO end showing PTO double universal connection and draw-bar connection. Curved lever provides on-off control of valves which permits unit to be shut off at ends of rows without disengaging PTO controls.

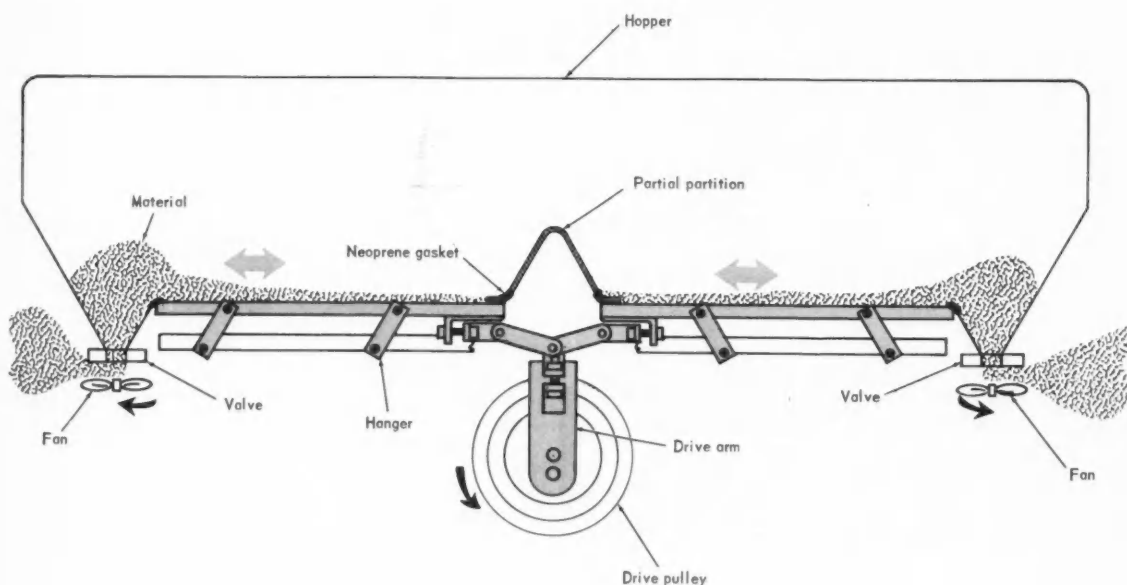


**FERTILIZER SPREADER** is towed behind tractor and driven off tractor PTO. Spreading is accomplished by centrifugal action through two power-driven spreader fans fed by large-diameter ports. Unit is capable of spreading at speeds up to 9 mph and at rates up to 19,000 lb per hour (depending on material), in swaths approximately 50 ft wide.

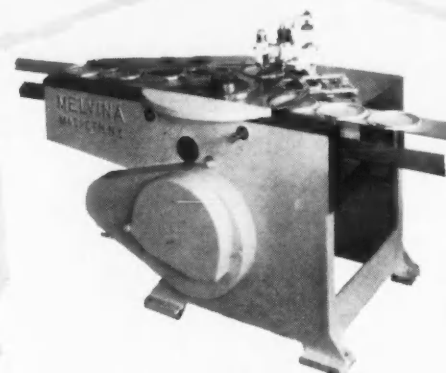


**SPREADER FANS** are driven off PTO shaft by simple V-belt arrangement.

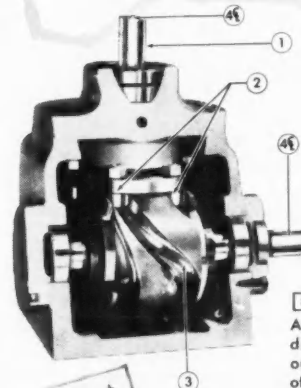
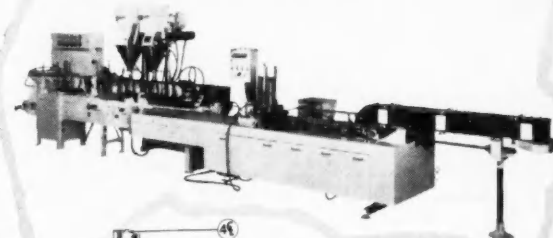
**SHAKER PANS** are driven off drive pulley by adjustable drive arm mounted on pulley crank pin. Drive arm actuates toggle pin which causes shaker pans (hopper bottoms) to move outward as toggle goes over center. Shaker pans move on inverted hangers, are connected to hopper sides by rubber gasket. Centering links restrict motion of toggle pin to control shaker-pan action. This results in a slightly greater motion of right-hand pan.



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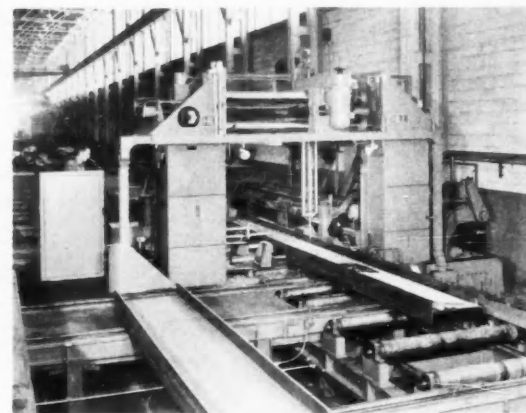
## IDEAS...MECHANICAL

### Ball Screws Locate

Robert L. Candlish, Detroit Editor

A small electric motor drives a ball-screw unit to positively position drill heads that are moved by hydraulic cylinders in a large multi-axis tape-controlled machine for automatically drilling holes in structural steel members.

The drilling machine, plus integrated handling conveyors, was designed to handle large beams and columns. It takes the place of the layout, space punching, reaming and radial drilling operations previously required. The unit locates

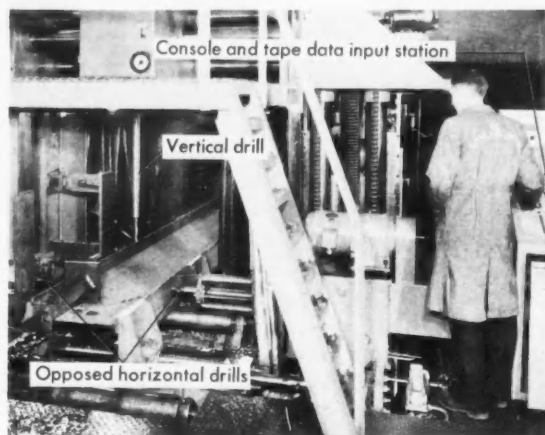


**DRILLING MACHINE IS EQUIPPED** with automatic conveyors for raw and finished work plus feed conveyor transporting work through drill. Factory cranes handle loading and unloading of these "run-in" and "run-out" storage conveyors. Machine operator has pushbutton control of storage conveyor to load and unload automatic feed conveyor. Feed conveyor travels 600 ipm for wide hole spacing or 60 ipm for close spacing. Creep speed is 12 ipm for final stop accuracy.

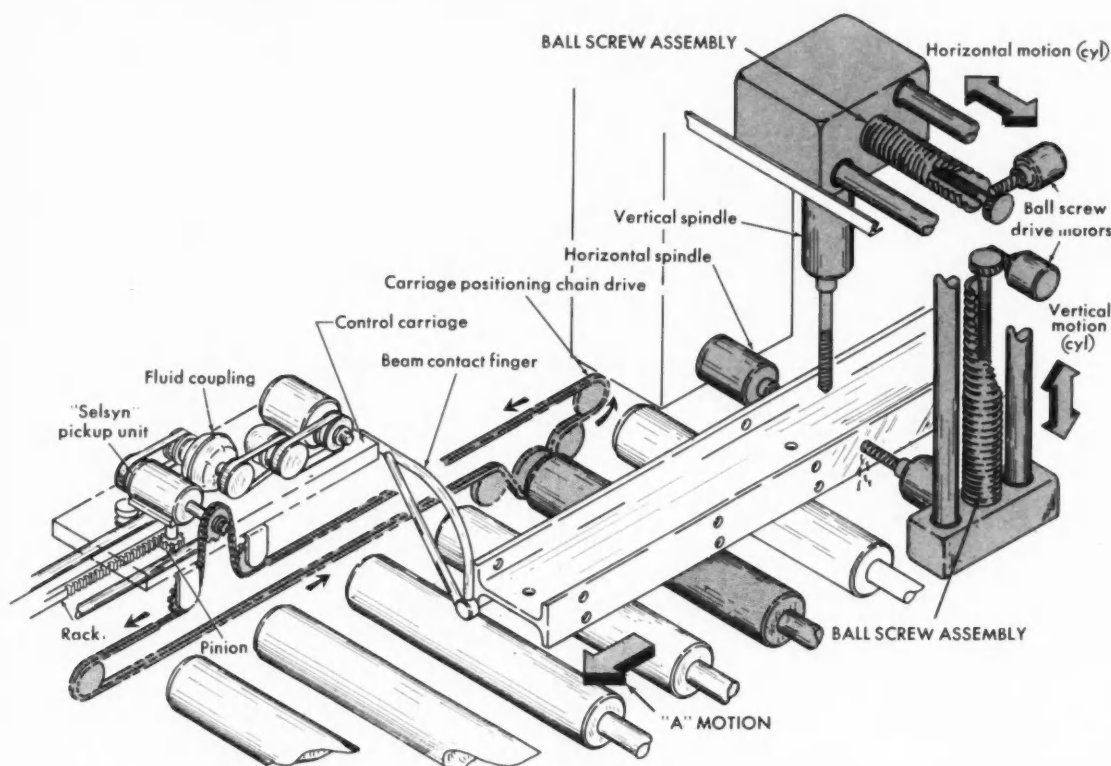
the beam under the drill heads in axial or "A" position and then positions drill heads to simultaneously produce holes in the upper and lower flange and the web sections. Motion of beam and drill spindle to new positions is simultaneous on completion of each operation. Beam is clamped and drill heads are locked in place during drilling.

The numerically controlled drilling machine for structural steel components was designed and built by Walter P. Hill, Inc., Detroit, Mich., for the R. C. Mahon Co. of Detroit. The numerical-positioning control system used is a General Electric Mark IV using Burroughs Corp. punched paper tape input.

## Hydraulically Moved Spindles in Automatic Drill

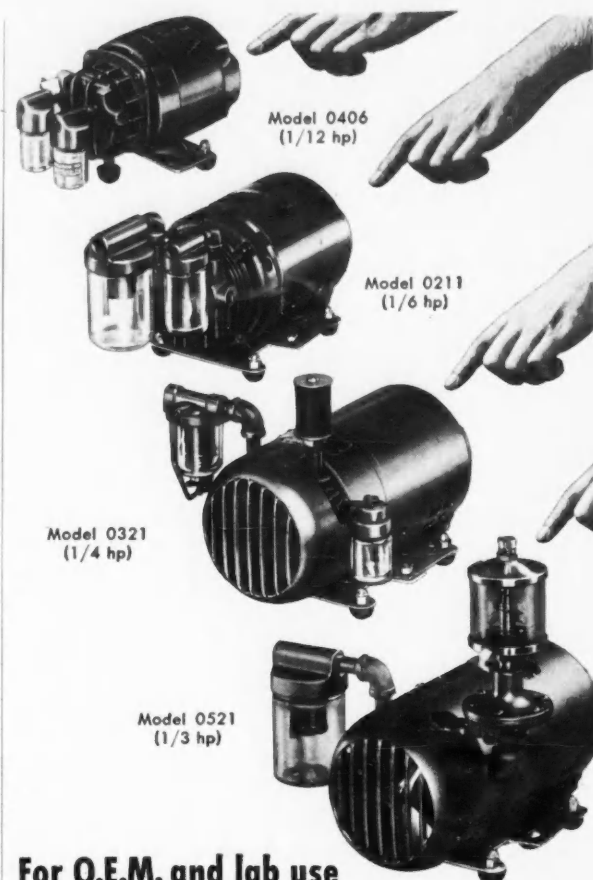


MACHINE MAY BE CONTROLLED by tape, dial or manually. Dial control permits accurate positioning and drilling of holes not programmed in tape. Manual control permits jogging drill forward or reverse outside of drill cycle. Machine capacity permits automatic handling of column 4 by 4 by 80 ft long. Six-inch standard beams are minimum size handled. Repeatable accuracy is 0.005 inch for beam positioning and 0.0005 inch for drill heads. Maximum drill size is 1½ inches dia.



"A" POSITIONING OF BEAM is by motorized conveyor rolls supplying transport energy and by "A" control carriage for position sensing and control. Beam and control carriage are advanced together by chain drive from motor to both carriage and conveyor rolls. Fractional-motor drive through fluid coupling on carriage tends to move carriage counter to beam movement to insure positive contact of carriage and beam regardless of slippage between beam and conveyor rolls. "Selsyn" pinion on carriage rolls on fixed

rack beside conveyor to sense "A" position. Drill heads are positioned similarly on all axes by hydraulic cylinder supplying energy, motorized lead screw supplying control and "Selsyn" pickup feedback unit sensing position. Hydraulic cylinder exerts constant force on drill head but cannot move it because of locked lead screw. Motor rotation of lead screw as directed by "Selsyn" sensing unlocks system, permitting heads to move. Constant hydraulic force takes up backlash in locked system.



## For O.E.M. and lab use —specify compact, INTEGRAL-MOTOR GAST VACUUM PUMPS

To save space . . . and reduce weight and mounting costs—use Gast Integral-Motor-Pump Models! For vacuum use—or fitted as air compressors—four sizes offer capacities from ½ to 3.8 cfm.

For completely oil-free air, Models 0406 and 0211 are available with oil-less construction (optional). Lubricated Models 0321 and 0521 have fan cooling. Vacuum ranges to 28" Hg, pressures to 25 psig.

Rotary-vane design is positive in displacement, quiet and long-lived. That's why engineers specify Gast Air Pumps as components for air sampling, industrial and laboratory instruments; printing, packaging and vending machines.

To acquaint yourself with other advantages, write for Bulletins V-P-356.

SEE CATALOG IN SWEET'S PRODUCT DESIGN FILE & A.S.M.E. CATALOG

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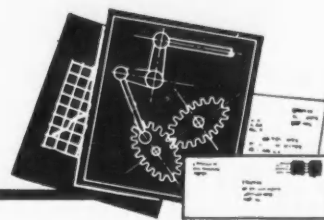
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- ☐ Have representative call. ☐ Send literature on seat checked.

NAME..... TITLE.....  
COMPANY.....  
ADDRESS.....  
CITY..... ZONE..... STATE.....

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## IDEA MART DESIGN NEWS

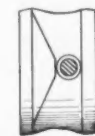
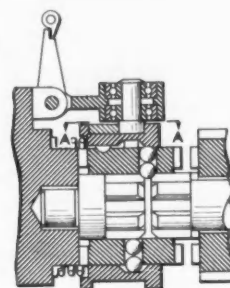


AVAILABLE

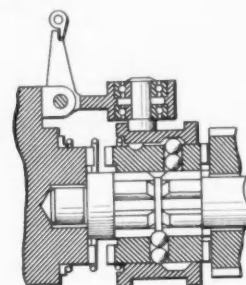
### Single-Revolution Clutch

This new and improved design provides either a single-revolution clutch or a half-revolution clutch, cam disengaged, spring engaged. Long life, repeated disengagement under full torque load creates imperceptible wear compared with a popular-type single revolution clutch presently on the market.

The clutch locks itself into engagement and out of engagement, but it is readily shiftable through the control means. It is suitable for starting and stopping a revolving shaft employed in various machines such as punch presses, automatic machine tools and automatic assembly machines. A considerable amount of development work has been done and drawings ready for production can be furnished. Patent license available. Write IM 518, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



SECTION A-A



## THE AMPLEXOLOGIST

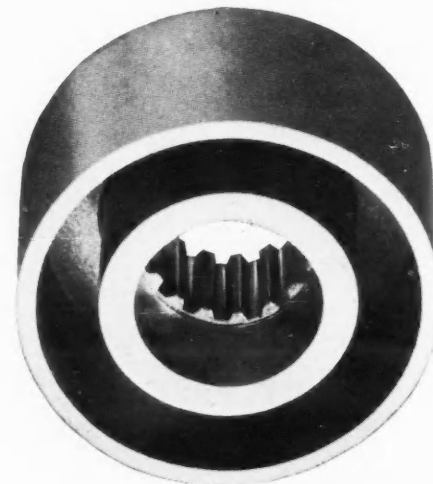
eliminates the scrap

The part shown is a magnet body for an electro-magnetic clutch. Because of the required magnetic properties, uniform wall density is highly critical. Previously, therefore, it was necessary to machine the entire part. The Amplexologist, however, designed it to be produced as a finished, precision powder metal part which requires no machining; and through advanced density control held specified magnetic properties, even in the counterbore. Approximate saving, 94%.



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AMPLEXOLOGIST'S SUCCESS

1 **ENGINEERING MANUAL**  
45 pages of technical information: How to determine correct applications for powder metal parts, bearings, filters.

2 **NEW BEARING STOCK LIST**  
20 pages, 1066 standard sizes of Oilite self-lubricating bearings—bearing material. Selection guide, engineering data.

Circle 15 on Reader-Service Card for more information

Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

## DESIRED

### New Products

We are located approximately 10 miles outside Boston and are interested in new product possibilities which have good potential for adequate return and fulfilling needs of available plant facilities.

Our interest is in any proprietary items which can be made out of ferrous or nonferrous materials and which require machining and or assembly. Items may be electromechanical or mechanical.

We have the experience and facilities for doing precision machine work in our machine shop, as well as assembly. Display area is available to assist our expanding sales organization if we can acquire the right products to meet our needs and existing operations. Write IM 500, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

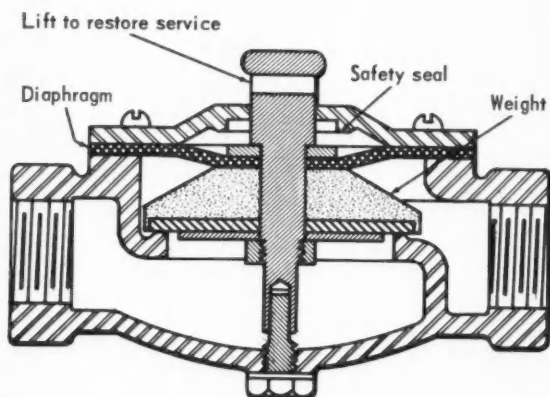
## AVAILABLE

### Automatic Shutoff Valve

This valve is designed to reduce possibility of explosion, fire from ignited gases and similar situations which could occur if service pressure is cut off and later resumed.

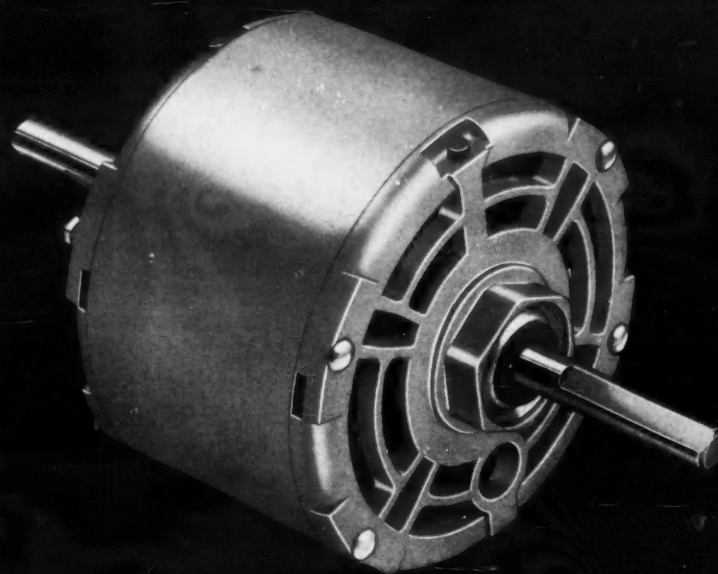
The valve has a valve seat larger than the diaphragm area so the pressure will keep the valve closed until opened manually. When the valve is open, the diaphragm seats against a seal seat in case a leak should develop in the diaphragm.

The valve remains open in operation until the service pressure is shut off, in which case the weight attached to the



valve disc and diaphragm closes the valve automatically. When the service pressure is resumed, the pressure will hold the valve seated until the valve is lifted or opened manually. Where the pressure is too great to lift the valve directly off the valve seat, a wire-type lever is provided. Write IM 519, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

## SPECIFY LEECE-NEVILLE MOTORS FOR QUALITY, RUGGED DESIGN, LONG LIFE



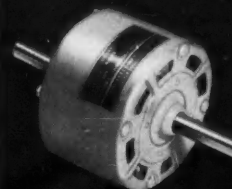
**ECONOMY AND RUGGED STRENGTH**—Model 6D Shaded Pole. 6 Pole—1050 rpm—1/12 to 1/4 hp. Quiet, smooth running power... ideal for air conditioning, refrigeration and heating service.



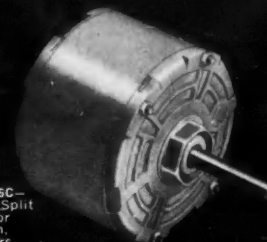
Model No. 2A—Shaded Pole for small pumps, fans, ventilators, blowers. 2 Pole—3,000 rpm.



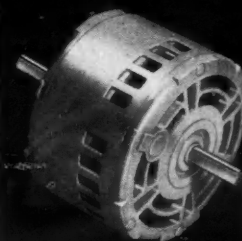
Model No. 4C—Shaded Pole for fans, ventilators, small blowers. 4 Pole—1,550 rpm.



Model No. 4D—Shaded Pole for blowers, pumps, air conditioning. 4 Pole—1,550 rpm.



Model No. 6C—Permanent Split Capacitor for refrigeration, fans, blowers. 6 Pole—1,050 rpm.



Model No. 6E—Permanent Split Capacitor for room air conditioners. 6 Pole—1,050 rpm.



LEECE-NEVILLE now offers you a complete line of shaded pole and permanent split capacitor motors—basic units adapted to your specifications, or special motors custom engineered to your requirements—with horsepower ratings from 1/150 to 1/2 hp. All L-N motors are capable of meeting U.L. and C.S.A. application tests. Leece-Neville has more than 50 years of experience manufacturing motors and other electrical equipment, and modern facilities assure not only top quality, but also delivery to your schedules and lead times. For full information, just mail the coupon at right.

Circle 16 on Reader-Service Card for more information

The Leece-Neville Company, Dept. DN-7  
Georgia Division, Gainesville, Georgia  
Please forward details on your shaded pole and permanent split capacitor motors.

Name \_\_\_\_\_ Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_  
Type of product \_\_\_\_\_



## HIGH SPEEDS? HIGH TEMPERATURES? CHEMICAL CORROSION?

For bearings, seals, blades and similar sliding or rotating parts, try PUREBON . . . particularly if you have a problem involving high speeds . . . high temperatures . . . or chemical corrosion.

### OUTSTANDING PROPERTIES OF PUREBON

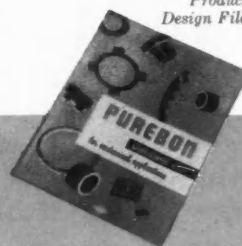
- |                                |                                     |
|--------------------------------|-------------------------------------|
| 1. Self-lubricating            | 5. Readily machinable               |
| 2. Chemically inert            | 6. Moldable to size                 |
| 3. Stable at high temperatures | 7. Low cost, where moldable to size |
| 4. Light in weight             |                                     |

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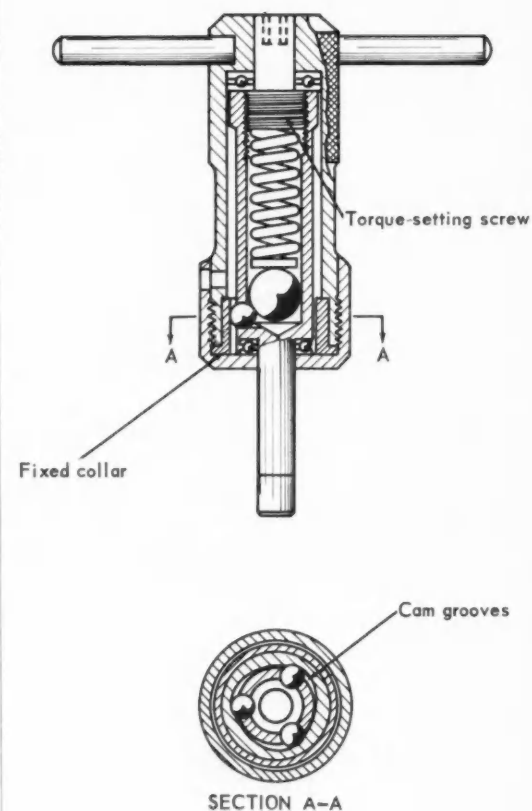
## PATENTS

### Torque Wrench

British Patent 856,136; Norman H. Elsey, M.H.H. Engineering Co., Ltd., Bramley, Guildford, Surrey, England.

This adjustable torque wrench uses a simple ball clutch which connects the driving outer casing with a driven rotatable inner housing. A large spring-loaded ball contacts three small steel balls in radial slots at the base of the housing. Three cam grooves machined in a fixed collar are positioned opposite the slots. While the balls are partly in the grooves, rotation of the casing transmits drive to the housing. The grooves have a steep angle on the driving side and a gradual slope on the other side. This arrangement permits the tool to ratchet in reverse direction by giving it a one-third turn.

When torque is applied to the casing, the balls projecting from the slots drive the housing and the integral spindle. Spring thrust acting through the large ball maintains the smaller balls in driving contact until limiting torque is exceeded. The smaller balls then overrun the grooves against the spring-loaded large ball and the clutch slips.





The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

#### FLEXIBLE DRIVE-SHAFT ASSEMBLY

U S Patent 2,982,117; Oscar M. Erpenstein, assignor to Doak Aircraft Co., Inc., Torrance, Calif.

#### POWER-TRANSMISSION MECHANISM

U S Patent 2,982,156; Daniel F. McGill, Portland, Ore.

#### ATOMIZING PUMP

U S Patent 2,982,215; William E. Baker, Toledo, Ohio.

#### DUAL NUTATING DISC APPARATUS

U S Patent 2,982,222; Eugene E. Ball, Jr., assignor to Thompson Ramo Wooldridge, Inc., Cleveland, Ohio.

#### HYDRAULIC OSCILLATOR

U S Patent 2,982,262; Hugo A. Panissidi, assignor to International Business Machines Corp., New York, N. Y.

#### SIGNAL STORAGE AND ACTUATING SYSTEM

U S Patent 2,982,292; Sterling T. Martin, assignor to Union Carbide Corp., N. Y.

#### FLOW-CONTROL DEVICE

U S Patent 2,982,300; Wilbur F. Jackson and John W. Wright, assignors to Robertshaw-Fulton Controls Co., Richmond, Va.

#### AIR-LINE LUBRICATOR

U S Patent 2,982,376; Paul A. Lincoln, assignor to Ingersoll-Rand Co., New York, N. Y.

#### FLUID-MIXING VALVES

U S Patent 2,982,476; Jack Witherspoon, Jr., assignor to Robertshaw-Fulton Controls Co., Richmond, Va.

#### SAFETY REEL

U S Patent 2,982,492; James F. Spielman, assignor to Aero-tec Industries, Inc., Conn.

#### SHOCK AND VIBRATION ISOLATOR

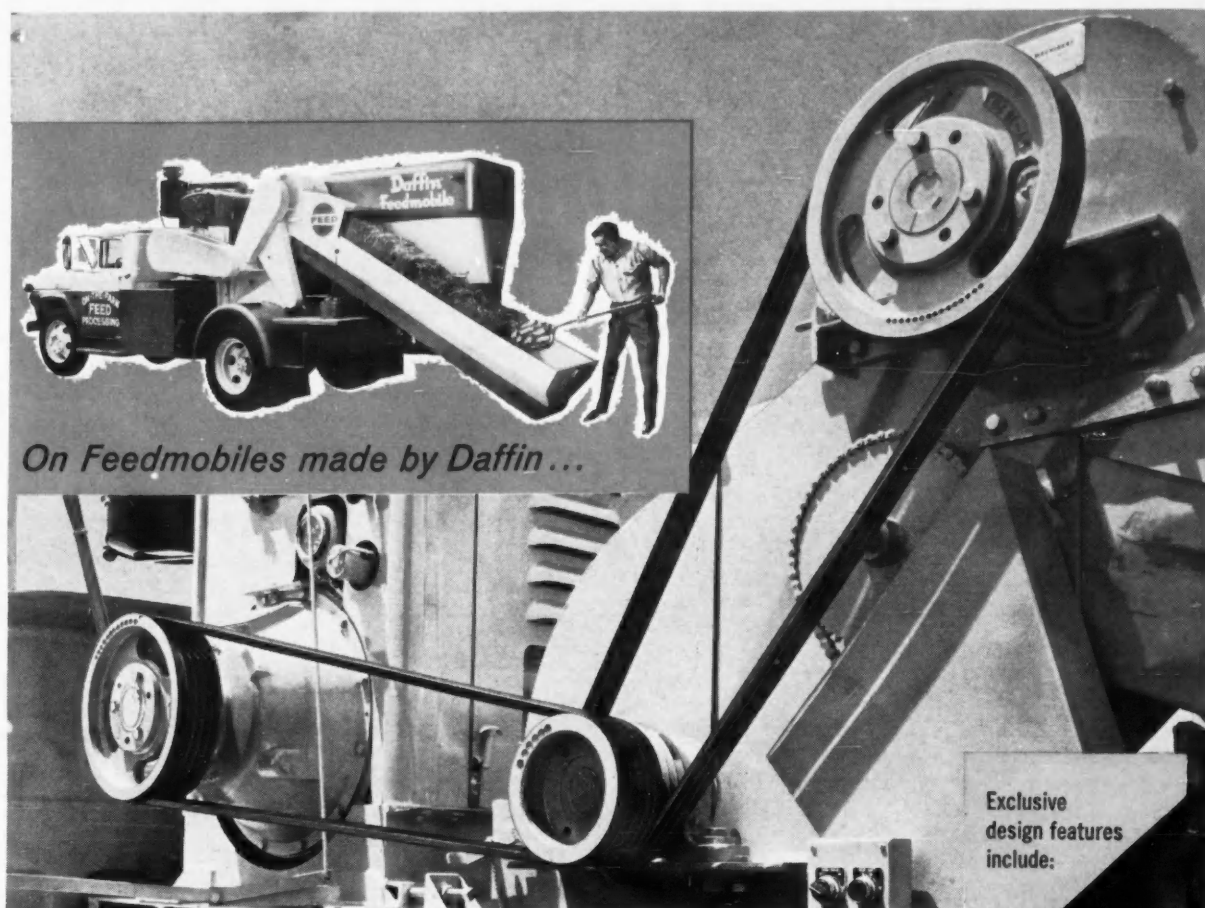
U S Patent 2,982,510; Loren E. Currison, assignor to Lear, Inc., Santa Monica, Calif., and Albert de Boer, Syosset, N. Y.

#### PRESSURE-OPERATED CONTROL VALVE

U S Patent 2,982,511; Douglas M. Connor, Watchung, N. J.

#### TEMPERATURE-COMPENSATED LIQUID-SPRING DEVICE

U S Patent 2,982,537; Rollin D. Rumsey, assignor to Houdaille Industries, Inc., Buffalo, N. Y.



On Feedmobiles made by Daffin...

## Gates Super HC Drives permit power increase of 20hp in less drive space

The Daffin Feedmobile is a well-designed, efficient feed mill on wheels made by Daffin Manufacturing Co. of Lancaster, Pennsylvania. Originally, all the power for grinding, mixing and blending was transmitted by conventional V-belt drives.

Early in 1960, the machine was redesigned to obtain the competitive advantages that result through use of Gates Super HC High Capacity V-Belt Drives.

An official of the company, John Skinner, Jr., says: "The Gates Super HC Drives let us increase the output of the diesel power plant from about 100 HP to 120 HP without reducing the original safety factor. Sheaves are narrower and are about 80 pounds lighter, reducing the overhang load on bearings, increasing bearing life. Guards are 4 inches

narrower, require less metal and are nearly 33% lighter weight. Drive cost for each machine has been cut 7 or 8%."

He says further: "The Gates High Capacity Drives have greatly strengthened one of our most important selling points—the fact that 'there is far less down-time with a Daffin.'"

Manufacturers everywhere have standardized upon the Gates Super HC V-Belt Drive—the first and most advanced high capacity drive. It is your best assurance that your power transmission unit will not soon become obsolete.

The Gates Fieldman located near you is a drive design expert. Contact him for technical information and assistance in designing Gates High Capacity V-Belt Drives.

The Gates Rubber Company, Denver, Colorado

## Gates Super HC V-Belt Drives

Circle 18 on Reader-Service Card for more information

Exclusive design features include:

precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Gates Super HC Drive saves space, weight and money



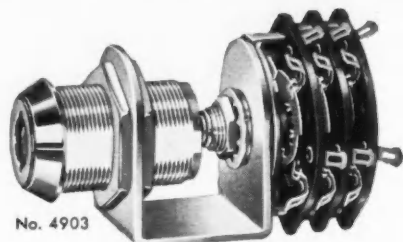
Building the future on 50 years of progress.

# NEW

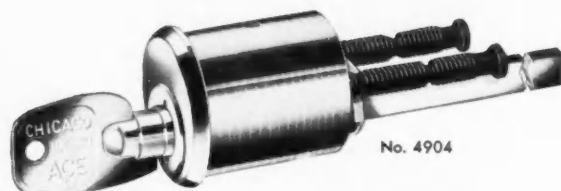
UNDERWRITERS'  
LISTED



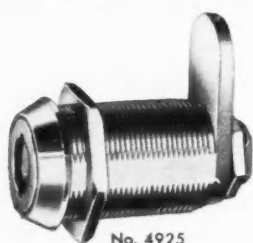
## CHICAGO ACE<sup>®</sup> PIN TUMBLER LOCKS



No. 4903



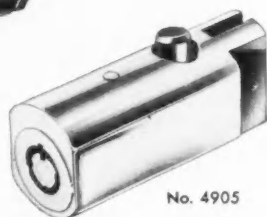
No. 4904



No. 4925



Hardened Steel ACE Key



No. 4905

Here is the only line of locks listed by Underwriters' Laboratories. The unique ACE Locks provide the maximum in mechanical security. Over 80,000 keying combinations are possible so that you may have your own factory-registered tumbler set-up. For technical details on models available for various applications, write for Switch Lock Bulletin UB 501.

### CHICAGO LOCK CO.

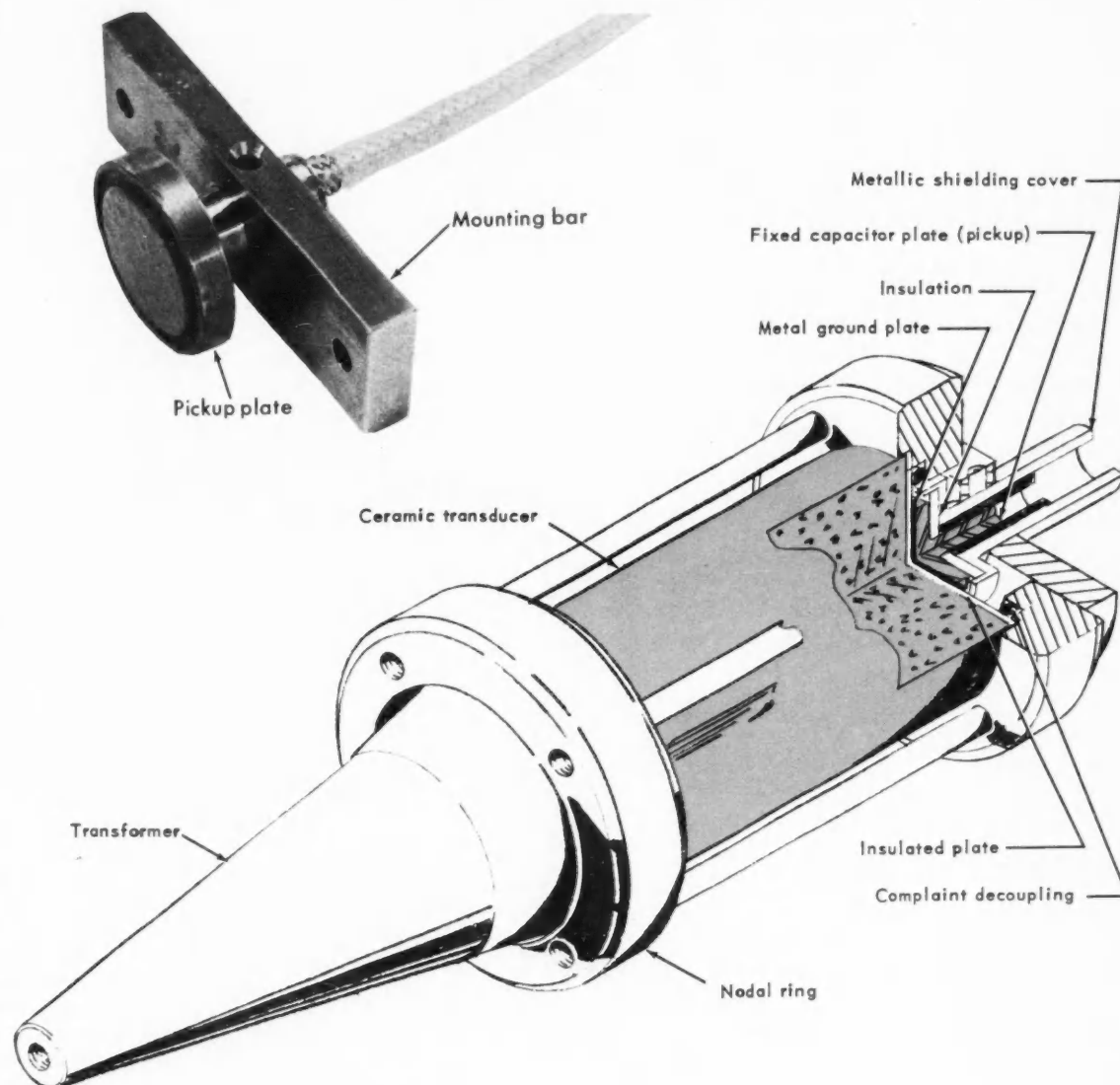
2038 N. Racine Avenue • Chicago 14, Illinois

DESIGN  
DESIGN IDEAS  
NEWS

ELECTRICAL

## Capacitive Pickup Monitors Ultrasonic Vibrations

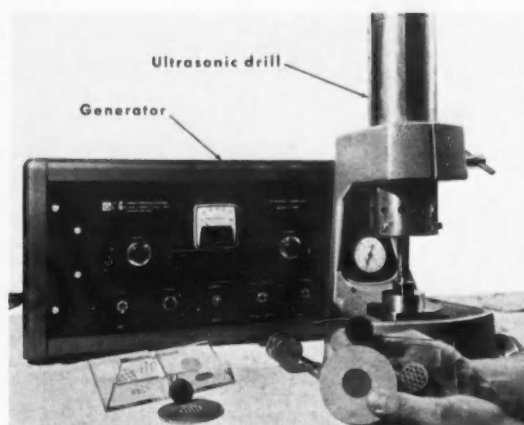
Victor W. Wigotsky, Eastern Editor



**FEEDBACK SIGNAL** must be in proper phase relationship to tip of transducer and have sufficient amplitude above noise region. Mechanical system must follow vibration of 20 kc and displacement of two- to five-thousandths of an inch. Impedance transformer amplifies small mechanical motions of transducer to larger motions for drilling. Design of pickup permits placement at point of transducer to produce optimum electrical signal. D-C voltage is impressed across plates of capacitive pickup. Varying d-c signal is created with ampli-

tude and phase, as ground plate position changes because of vibrations. Amplitude reaches peak and phase approaches that at tool tip as resonance is approached. This signal is fed through amplifier to phase discriminator, where it is compared to reference signal. Resultant signal, depending on phase of pickup signal, causes reactance tube oscillator to change its frequency until it delivers signal in phase with pickup signal. In this way, generator continuously follows transducer's resonance.

Circle 19 on Reader-Service Card for more information



**DRILL** cuts any hard or brittle material to precision tolerances. Unit can perform many other cutting functions as well as drilling. Pickup device and feedback circuit permit tuning generator with transducer at setup. Entire system then remains in tune throughout drilling operation.

An ultrasonic drill uses a capacitive-type pickup to function as a "vibration monitor". The pickup provides a feedback signal to the RF generator to keep the transducer at its resonant frequency during drilling.

A major problem in ultrasonic drilling is the desirability that the energy source follow the resonant frequency of the electromechanical transducer. Significant loss in power results if the transducer's vibration frequency does not stay in tune with the driving generator. The pickup and feedback circuit automatically adjusts generator frequency equivalent to the frequency shift of the transducer's vibrations.

The capacitive pickup operates on the variation in distance, with vibration changes, between a moving plate at ground potential and a plate fixed to the nodal point of the piezoelectric ceramic transducer. During drilling, the pickup senses the motion of the tool tip. Signals resulting from changes in transducer motion then are fed to an electronic circuit. Generator frequency is adjusted until it delivers a signal which agrees in phase with the pickup signal. The generator thus always follows the resonance of the transducer to keep the unit at optimum performance.

An insulating plate, fixed to the movable ground plate, is bonded to the transducer. This provides isolation from the high RF voltage at the rear of the transducer and also permits the desired capacitive effect resulting from the vibrations. The capacitor's fixed plate is mounted at a point of no motion (nodal point) so that it is not subject to acceleration, and thus does not load the transducer.

The Model D-101A Glennite ultrasonic drill was designed by Gulton Industries, Inc., Metuchen, N. J.

## HEXCEL HONEYCOMB ABSORBS 9 G's FOR ASTRONAUT

When Freedom VII opened its parachutes after re-entry, Hexcel crushable aluminum honeycomb absorbed 9 g's deceleration force, to help bring the first U. S. astronaut safely back to earth.

Use of crushable honeycomb for control of forces on decelerating objects is now being applied to such varied tasks as packaging fragile items, providing impact-limiting linkages in landing gear structures and cushioning the impact of air-dropped supplies.

### The Problem

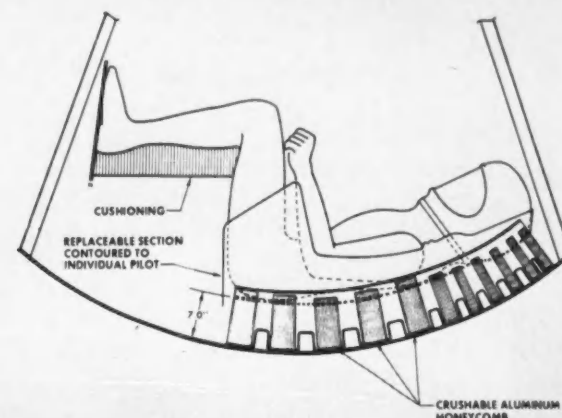
Instances requiring impact energy absorption are generally typified by low tolerable deceleration rates for the structure or its contents, high impact velocities, and small maximum allowable stopping distances. Such absorbers as mechanical springs, sponge or solid rubber, foams, cork, and wadding generally exhibit spring characteristics, in that the force transmitted through these absorbers to the object being stopped increases continuously through the distance in which the absorbers contract. In addition, many of these materials do not absorb energy, but merely store it for release as rebound energy.

If an absorber could exert a relatively constant non-rebound force throughout the entire stopping distance, that distance could be shortened, or alternately, the maximum force acting on the object in the same stopping distance could be materially reduced.

### INFORMATION REQUEST

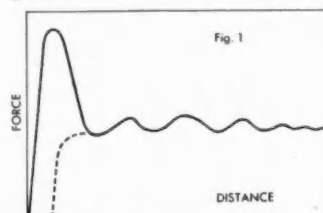
Send to Hexcel Products Inc., Dept. D-7  
2332 Fourth Street, Berkeley 10, California.

NAME \_\_\_\_\_  
TITLE \_\_\_\_\_  
COMPANY \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



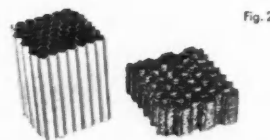
### Advantages of Honeycomb

Honeycomb core materials tend to follow such a constant force curve, as shown in Figure 1.



The initial peak on the curve represents the point at which compressive failure begins. This peak can be lowered by prestressing the core to produce slight initial compressive failure. When subjected to further or subsequent loading, the prestressed core proceeds immediately to carry the crushing load, as shown by the dashed line curve in Figure 1.

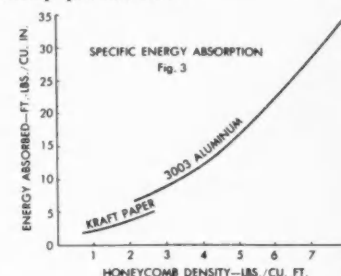
Figure 2 illustrates the appearance of aluminum honeycomb core before and after compressive failure.



By designing a honeycomb core assembly with a specified cell depth this constant force can be applied over a predetermined stopping distance.

### Available Materials

These principles apply to aluminum and paper honeycomb, and most similar honeycomb core materials fabricated from ductile metals and fabrics. Figure 3 indicates the general range of energy absorption capacity available in aluminum and paper materials.

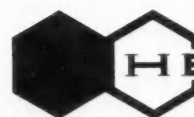


These capacities can be further increased by filling the cells with various foamed materials.

### Optimum Solution

The choice of materials by the designer will depend upon the particular requirements of the application. But it seems apparent that the utilization of honeycomb offers the optimum solution—in terms of weight and volumetric efficiency—to many types of energy absorption problems.

If you would like further information on the uses of honeycomb for energy absorption or other applications, consult *Sweet's Product Design* catalog or complete the information request at left.



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Circle 20 on Reader-Service Card for more information

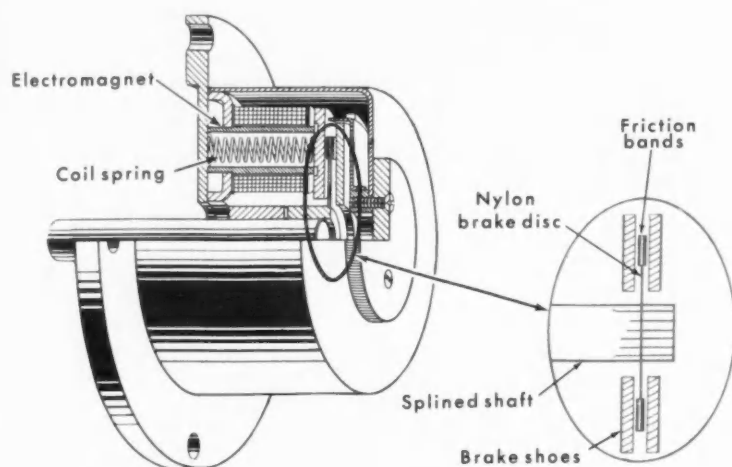


# NEW PRODUCTS

Circle number on Reader Service card  
for more information

## Fractional-Horsepower Brakes

301



### Utilize Nylon to Solve Noise Problem

Noisy operation of brakes caused by backlash between splines of a steel shaft and steel brake disc has been solved with bonded fibers, laminates, various synthetics and nylon. Discs stamped from "Polypenco" nylon strip eliminate the problems of noise, wear and fabrication. Tight fit and resilience of nylon provide quiet running during 700,000 test cycles. Nylon's resilience has a sound-damping and

◆ **NYLON BRAKE DISC** provides quiet running and accurate fit in fractional-horsepower brake. Brakes are used on automated rotating office files. Disc is mounted on splined steel shaft, rotates freely between two brake shoes. Electromagnets retain brake shoes until current is shut off, when coil springs advance shoes against disc. Nylon provides tight fit between disc and shaft splines and insures accurate positioning of files.

shock-absorbing effect that prevents slight vibrations from producing noise. Nylon's wear and abrasion resistance also preserves the disc's fit by preventing wear between disc and shaft splines. The brake maintains accurate position, prevents drift and employs a single disc faced on each side with a friction band. The 3-inch disc, with a splined hole in the center, is mounted on a splined shaft and revolves freely between two brake shoes which are retained by electromagnets. When the current stops, electromagnets release brake shoes. Coil springs in the cores of the electromagnets advance the brake shoes against the brake disc almost instantly, arresting motion of the disc and shaft.

Polymer Corp., 2120 Fairmont Ave., Reading, Pa.

## Electromechanical Linear Actuator

Employs Induction Principles to Deliver Uniform Stroke

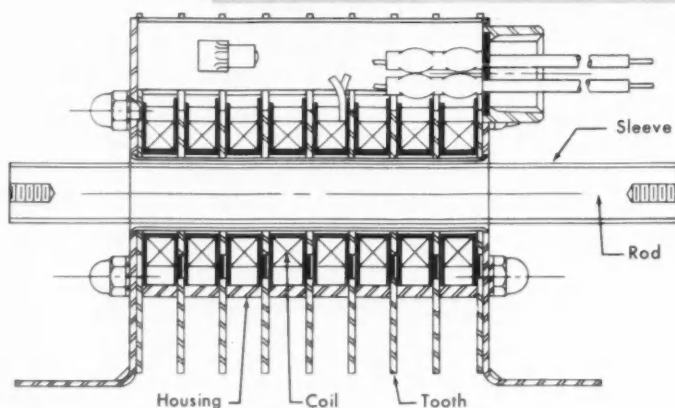
302

## Miniature Pressure Transducer

303

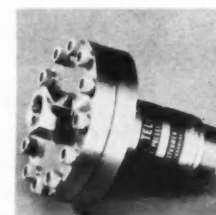
LINEAR ACTUATOR SPECIFICATIONS

RATED VOLTAGE (Three-phase unless otherwise specified)	CONTINUOUS DUTY HOLDING FORCE	STANDARD STROKE
220-60	1.2 lb	0 to 3.0 inches
110-60 single phase	1.0 lb	0 to 4.0 inches
220-60	1.5 lb	0 to 4.5 inches
440-60	1.5 lb	0 to 4.5 inches
220-60	2.0 lb	0 to 6.0 inches
440-60	2.0 lb	0 to 6.0 inches



The "Polynoid" linear actuator provides reliable and easily controlled motion at low installed cost. The unit contains only one moving part—the rod—and can be used to hold under load at any position or provide reciprocating motion. Stroke is up to 6 inches with standard units and is virtually unlimited in engineered products. The device produces uniform output force throughout its stroke in either direction. Output force is directly proportional to input power.

Skinner Precision Industries, Inc., New Britain, Conn.



Designed for airborne applications involving the precise electrical measurement of fluid and gas pressures from 0 to 50 psi, Model 179 transducer maintains a pressure measurement accuracy of 0.25 percent over a wide temperature range. The stainless-steel

housing permits measurements of most fluids and gases including such corrosive substances as red fuming nitric acid, liquid oxygen, peroxides, alkalis and, with slight instrument modification, even fluorine. Four precision strain gages are bonded to a one-piece, "Ni-Span-C" proving ring to form the Wheatstone bridge measuring element. Dual metal diaphragms separate the pressure cavity from the electrical measuring chamber. Application of three times the rated full-scale pressure will not damage the instrument nor necessitate recalibration. It can be used with either a constant-voltage or constant-current system.

Taber Instrument Corp., 107 Goundry St., North Tonawanda, N.Y.

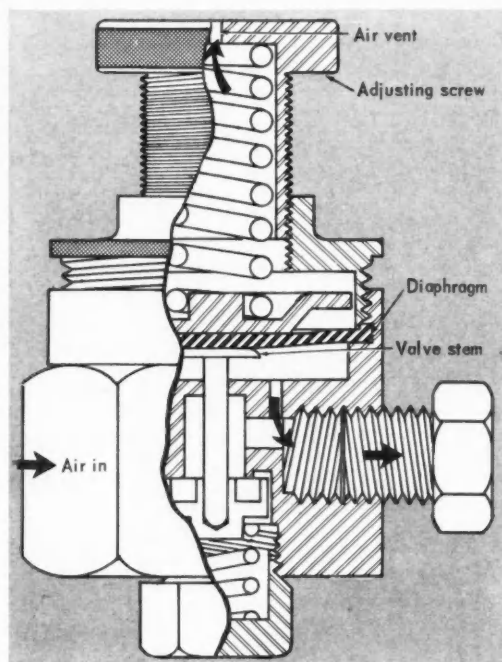
## 400-PSI Miniature Regulator

304

### Delivers Secondary Pressures Of 5 to 125 PSI

Primary pressures up to 400 psi can be regulated to 5-125-psi secondary pressures with this compact component. The pneumatic unit delivers up to 80 cfm at 100 psi with 200-psi inlet pressure. Maximum operating temperature is 200F. Model 2017 has a gage port and Model 2018 is without a gage port. The "Banti-Reg" measures only 2-1/4 inches high and 1-7/16 inches wide. Both models are standard with 1/4-inch NPT inlet and outlet, but 1/8-inch NPT connections are available. Constructed of all brass with a neoprene diaphragm, the device will safely handle gases and fluids.

Wilkerson Corp., 1649 W. Mansfield, Englewood, Colo.

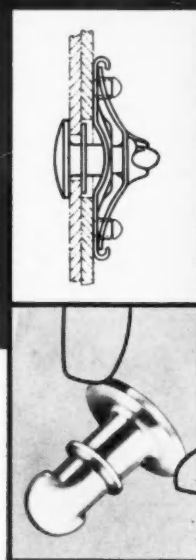


WITH AIR ON, adjusting screw is turned until needle on air-gage points to pressure setting desired. As air is used, it is drawn from outlet port and from under diaphragm. Spring pressure of diaphragm becomes greater than air pressure under diaphragm. This forces diaphragm down, also forcing down valve stem. Inlet air pressure (primary pressure) is unregulated and is backed up against valve's seat assembly. This admits unregulated air pressure to flow through to outlet port and to under side of diaphragm.

## Criteria of Reliability...



### BOEING 707 Jet Stratoliners



## use LION Quarter-turn FASTENERS

The demands of today's airborne requirements are met by Lion Quarter-turn Fasteners. They are accepted as

standard throughout the aircraft industry. They are completely reliable . . . stand up under the most rugged conditions of shear, vibration and tension.

Smooth positive action is assured by the swaged-nose stud on Lion Quarter-turn Fasteners. There are no milled sections, inserts or cross pins; no potential points of failure. No wire spring is required to hold the Fastener in locked position.

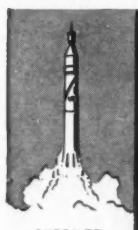
One-quarter turn locks the Fastener . . . one-quarter turn opens it. Six head styles and two sizes available. Lion Aviation Fasteners meet MIL-F-5591A (ASG) requirements and are CAA approved.

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SOUTHCO FASTENER HANDBOOK

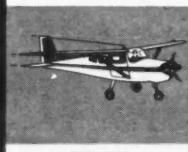
Contains complete engineering data on  
Lion Quarter-turn Fasteners and many  
other special Fasteners. Write to:  
SOUTHCO DIVISION, South Chester  
Corporation, 232 Industrial Highway,  
Lester, Pa.



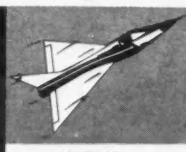
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MISSILES



CIVILIAN



MILITARY



COMMERCIAL

## LION Aviation FASTENERS

one of the



L-6

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#### AMPLE STOCK FOR POWER TRANSMISSION

Acme Distributors always maintain a large stock of roller chains and sprockets, neatly packaged in convenient cartons plainly marked for easy handling, identification and shipping. All standard size roller chains, sprockets and flexible couplings, are stocked to give you immediate service.

#### EFFICIENT OFF THE SHELF SERVICE

Your Acme Distributor is always ready and willing to do all he can to improve the efficiency of your operation and prevent unnecessary slow-downs by keeping a full line of chains, sprockets and other power transmission items on hand at all times.

#### IMMEDIATE DELIVERY

Your Acme Distributor is willing and ready to give you fast, prompt action at all times. Whether it's delivery, service or advice, you'll find him a dependable and helpful man to do business with.



For ample stock, efficient service and top speed on Power Transmission Products, contact your Acme Industrial Distributor today!



Write Dept. 14-Z  
for new ill. 100 page cata-  
log with engineering section.



#### RELIABLE CHAIN DRIVES FOR ALL INDUSTRIES

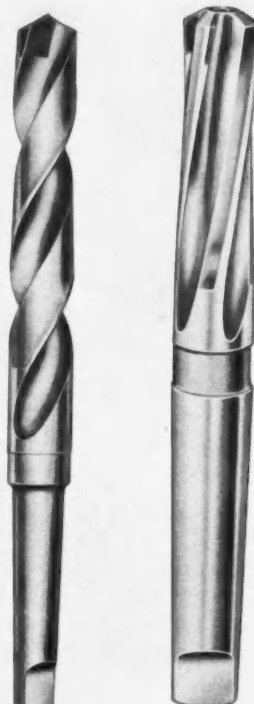
ROLLER CHAINS, SPROCKETS, CONVEYOR CHAINS, FLEXIBLE COUPLINGS, ATTACHMENTS. (Special and Standard)

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#### MECHANICAL

#### Twist Drills

305



Thirteen high-speed steel, solid-carbide and carbide-tipped drills added to this line represent a total of more than 550 different sizes available. Among the new drills now listed are: solid-carbide drills in fractional wire and letter sizes (115 sizes); combined drills and countersinks (16 sizes); drill blanks (137 sizes); carbide-tipped drills, straight and taper shank in fractional, wire and letter sizes (210 sizes); carbide-tipped core drills (33 sizes) and drills for hardened steels (44 sizes). All drills are "standards" and are available from stock through industrial distributors.

American Twist Drill Co.,  
14301 W. Chicago Blvd., De-  
troit 28, Mich.



## BALCRANK MAKES THE BEST!

#### HAND WHEELS

Best quality, fine grain cast iron. Rim and handles polished to high luster. Handles are revolving, solid or omitted. Available in standard sizes 4" to 12" dia. with plating, broaching or other machining to your specification.



#### SOLID AND REVOLVING MACHINE HANDLES

Revolving handles turn on HARDENED steel spindle with permanent graphite grease lubrication permitting FASTER, EASIER adjustment by user. Machined from quality BAR STEEL ground and POLISHED to a smooth, high luster.



BALANCED  
CRANKS



COMPOUND  
RESTS



CLAMPING  
LEVERS

WRITE FOR FREE CATALOG AND PRICE LISTS TODAY!

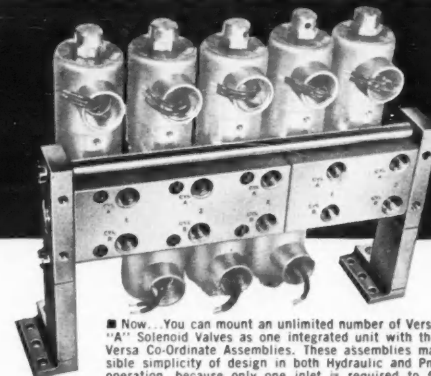
Machine  
Tool  
Division **BALCRANK INC.**  
14 DISNEY ST. • CINCINNATI 9, OHIO, • U. S. A.

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## UNLIMITED MANIFOLD MOUNTING OF VERSA SERIES "A" SOLENOID VALVES

WITH **VERSA**

## Co-Ordinates



Now... You can mount an unlimited number of Versa Series "A" Solenoid Valves as one integrated unit with these new Versa Co-Ordinate Assemblies. These assemblies make possible simplicity of design in both Hydraulic and Pneumatic operation, because only one inlet is required to feed the entire line of valves. Additional blocks can be added at any

time and blocks with and without adjustable built-in bleed controls can be used together in one unit. Combined with Versa Series "A" Valves these Co-Ordinates provide the most flexible and reliable Multiple Solenoid Valve Assemblies in the Control Valve field. Write for Bulletin # 960.

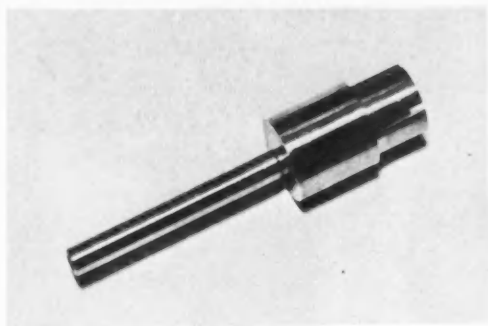


**VERSA PRODUCTS COMPANY, INC.**  
150 Coolidge Ave., Englewood, N. J.

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DESIGN NEWS—JULY 7, 1961

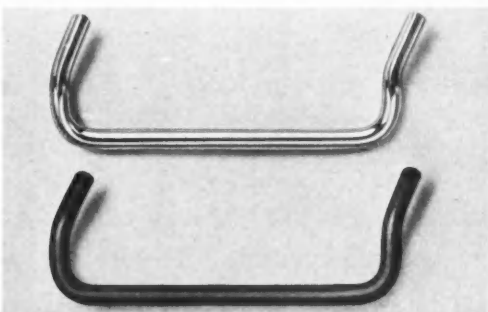




Designed to extend working length of like-sized shafts, precision units may be used also as adapters to standardize shafts of unlike diameters. Machined from 303 stainless steel, with clear passivated finish, in 1/8-, 3/16-, or 1/4-inch shaft sizes, extensions are furnished with same size male and female ends or in any combination of these sizes. Overall length of extension is 1-5/8 inches, providing for one full inch of usable shaft surface. All diameters are concentric to 0.0005 inch.

Pic Design Corp., 477 Atlantic Ave., East Rockaway, L. I., N.Y.

## Offset Handles 307



When mounted on a panel, these handles extend 1-1/2 inches and are offset at a 45-deg angle. This offset feature permits functional efficiency within limited space restrictions. Handles are 1/4 inch in dia and are either brass or aluminum. Size is 4 by 1-1/2 inches. Part numbers are 1254 (brass) and 1255 (aluminum). Brass rod is per ASTM-B-121, Alloy 4 with black oxide finish or light polish and 0.0005-inch nickel plate. Aluminum is 2011-T3 rod, per QQ-A-365, Comp. A, Temper T3 with black anodize, per MIL-F-14072 or a micro-etched semifrost finish. Mounting threads are No. 8-32 NF-2B.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

*What's News in Plastics...*

# LONG TERM HEAT AGING STABILITY



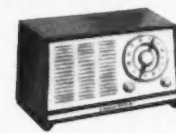
Washing Machine Parts



TV Backings



Vaporizers



Radio Cabinets

## Yours with new Escon<sup>®</sup> 125 molding grade polypropylene!

Household appliances, radio cabinets and TV backings take full advantage of the remarkable properties of Escon 125 polypropylene. This outstanding new grade is designed to maximize performance for long periods at high temperatures. Exceptional performance is achieved through a special LTHA (Long Term Heat Aging) stabilization system developed by Enjay research affiliates.

Escon 125 offers oxidative stability

that, in carefully conducted laboratory tests against other commercially available grades of polypropylene designed for this type of service, outperformed all others tested. Specimens of Escon 125 withstood almost three months of oxidative aging at 300°F; specimens exposed to 250°F have shown no signs of failure after seven months.

Melt index is 5.5 at 230°C. No changes are required in equipment, processing conditions or coloring tech-

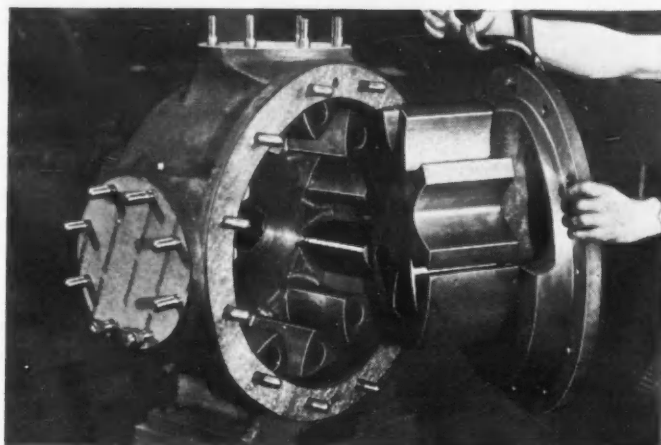
niques from those used with general purpose molding grades. For test samples and typical properties of new Escon 125, write to Enjay, 15 West 51st Street, New York 19, New York.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY  
**ENJAY CHEMICAL COMPANY**  
 A DIVISION OF HUMBLE OIL & REFINING COMPANY

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# GEARED TO HANDLE PUMPING PROBLEMS



THE VIKING "GEAR-WITHIN-A-GEAR" PUMPING PRINCIPLE helps engineers solve a wide range of pumping problems throughout the world. In the petroleum industry, chemical processing, food processing, meat packing, road building and many other industries, **VIKING PUMPS** handle liquids and semi-solids efficiently and at low cost. And **VIKINGS** pump liquids ranging from thin, liquefied gas to thick, viscous tars. Originated 50 years ago, the **VIKING** pumping principle has been adapted so successfully to so many applications that **VIKING** is now the largest exclusive rotary pump manufacturer in the world.

You men who specify and buy rotary pumps, can select from a complete size range of **VIKING PUMPS**, from 1/2 to 1050 G.P.M. in over 850 catalogued models and thousands of special designs. If you have a pumping problem, tell us . . . and ask for catalog 615J.

**VIKING PUMP COMPANY**, Cedar Falls, Iowa, U.S.A. In Canada, it's "Roto-King" Pumps. See Our Catalog in Sweet's Product Design File.

Circle 26 on Reader-Service Card for more information

## NEW CURVED brazing washers and shims

The operator no longer needs three hands to put the components together!

Applications on which one tube is radiused or saddled to fit over another are sometimes difficult to preform with a washer or shim. The stiffness of the washer may hold the radiused member away from the other tubes. By curving the washer to the curvature of the tube, the problem is minimized. Curving a shim permits snapping of the shim onto the tube.

Write for FREE  
20 page "PREFORM  
BRAZING HAND-  
BOOK"



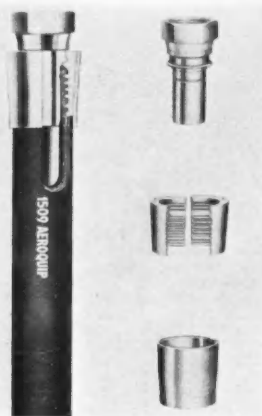
**LUCAS-MILHAUPT Engineering Co.**  
5051 South Lake Drive, Cudahy, Wisconsin

Circle 27 on Reader-Service Card for more information

# MECHANICAL

## High-Pressure Hose Fitting

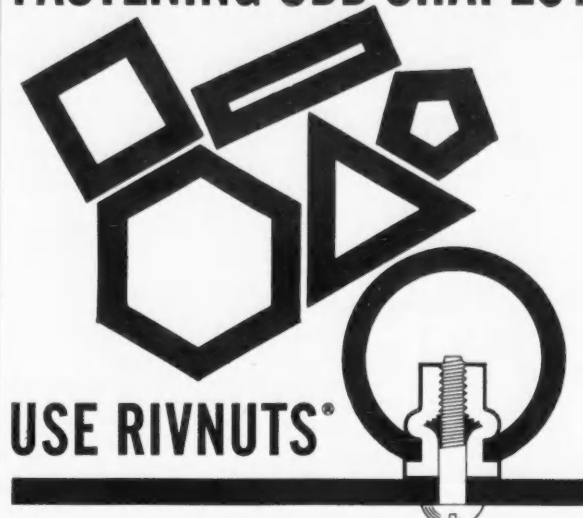
308



A detachable, reusable fitting for high-pressure hose assemblies is designed especially for industrial markets, such as construction equipment and heavy automated machinery. The fitting is recommended for a wide range of high-pressure hydraulic and pneumatic applications, as well as for fuel and lubrication systems. Fittings are produced in 10 end styles, including male pipe, JIC swivel, JIC male flare, SAE straight thread, JIC swivel elbow fittings (both 45- and 90-deg configurations) and split-flange fittings (straight, 45 and 90-deg). Though simple to assemble and install, the three-part fitting makes incorrect assembly virtually impossible. Hose lines made up "on the job" require only simple hand tools. The unit has been designed for hose sizes ranging from 1/4 to 2 inches. The 1509 high-pressure hose used with "Iron Mike" is suitable for operation in temperatures ranging from -40 to 200F and for use with hydraulic fluids, crude oil, fuel and lubricating oils, gasoline and air.

Aeroquip Corp., Jackson, Mich.

# FASTENING ODD SHAPES?



## USE RIVNUTS®

RIVNUTS are completely installed from the exterior of the work — thus are ideal fasteners for odd shapes and hard-to-reach parts. Simply drill the hole, insert RIVNUT, upset with heading tool. Provides sturdy nutplate with internal threads for insertion of screw. For complete story in RIVNUT Data Book write Dept. DN-7A B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Akron, Ohio.

B.F. Goodrich

Rivnuts

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## SOLVE BEND RADII & TORSION FATIGUE PROBLEMS



SEND FOR THIS INFORMATIVE CATALOG TODAY. OVER 2,000 DIFFERENT TYPES, STYLES & SIZES AVAILABLE

## USE CHIKSAN SWIVEL JOINTS!

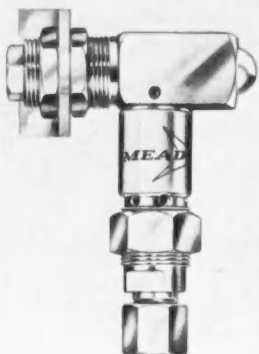
When moving parts cause tight bend or torque on hose lines or when design dictates the use of metal lines, Chiksan Swivel Joints can provide the ready solution. Full 360° rotation, infinite service life, and high safety factor enable Chiksan Joints to literally pay for themselves after short periods of use.

**CHIKSAN COMPANY** BREA, CALIF.,

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DESIGN NEWS—JULY 7, 1961

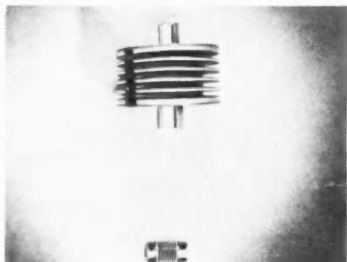
## Interlock Limit Valve 309



A pneumatic pilot actuator bleeds only enough air to shift a master valve before closing itself automatically. Designated No. 408, the component actuates differential-pressure master valves of the pilot bleed type. Bleed duration may be varied to meet circuit requirements that change with distance from master valve, master-valve capacity and speed of actuation. The unit finds applications in circuits that call for one limit-valve plunger to stay depressed throughout a series of operating cycles.

Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.

## Bellows Couplings 310



Subminiature to medium-sized couplings can be used for all sensitive applications. The miniature sizes are applicable to servo-mechanisms and computers where backlash and cyclic angular variations between two shafts cannot be tolerated. The high flexibility of these couplings can be used to stretch or compress to drive a screw while rotating and has negligible side thrust on bearings.

Sterling Precision Corp., 17 Matinecock Ave., Port Washington, L.I., N.Y.



Circle 30 on Reader-Service Card



## BEARING WITH A RED HOT FUTURE

**SKF**

MOTION ENGINEERING

Advanced ball and roller bearing technology

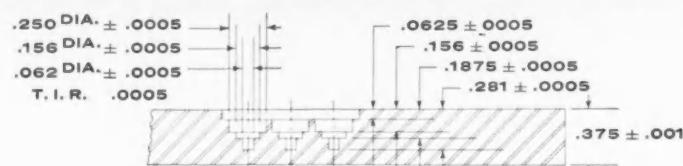
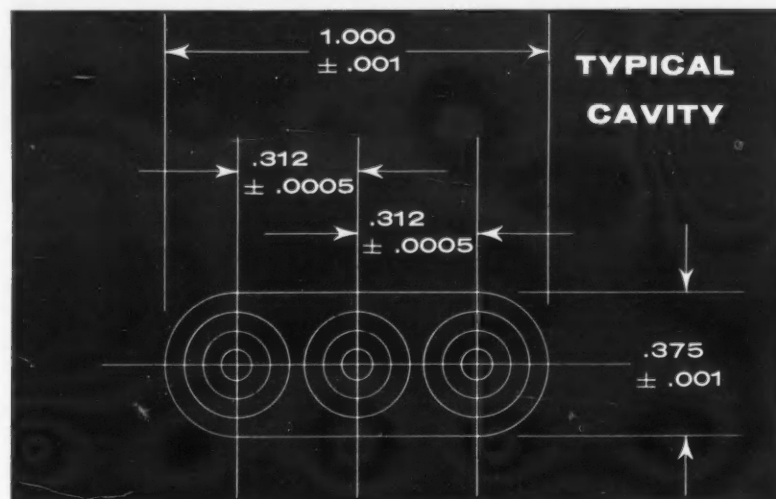
On special test equipment in SKF's research laboratory, experimental ball and roller bearings are run at temperatures up to 1000° F and above—conditions under which steel becomes red hot and loses its strength, while conventional lubricants burn or boil away. To meet these problems, bearings made of special heat-resisting alloys and exotic new materials are tested and evaluated. New ideas in design and new approaches to lubrication are constantly being investigated.

Bearings to resist extremely high temperatures are needed for improved, high performance jet engines, gas turbines and other equipment. Special SKF bearings have been tested successfully in environments at about 1000° F. Under certain conditions of operation, much higher temperatures are practical.

Research like this is your assurance that SKF will always keep pace with demands for the highest possible performance in all major types of rolling contact bearings—ball, cylindrical roller, spherical roller, tapered roller and precision miniature. SKF Industries Inc., Philadelphia 32, Pa.

6103





## UNBELIEVABLY CLOSE TOLERANCES

*on graphite jigs and fixtures  
... but Speer can hold them!*

Here are a few examples—

- Concentricity of drill holes to .0005 T. I. R.
- Drilled holes as small as .005 held to ± .0005
- Depth of holes held to ± .0005
- Oblong or "pork-chop" type cavities—length and width held to ± .001, depth held to ± .0005

Combine Speer's superb machining skill with the wonders of Speer Graphite itself and you have the perfect solution to many high-temperature problems. Graphite actually gets *stronger* as it gets hotter... does not warp... will not split or break down under severe thermal shock. It is chemically inert and is not wet by molten metal or glass. Speer Graphite is the ideal material for many high-heat applications, such as transistor jigs, fusing positioners, honeycomb jigs, furnace fixtures, brazing jigs, glass-to-metal seals.

**BRING YOUR PROBLEMS TO SPEER!** Years of experience in solving tough high-temperature forming and positioning problems with graphite, plus Speer's unusual fabricating skill, provide hundreds of answers for the aircraft, electronics and powdered metals industries.

To obtain full information on Speer Graphite and Speer machining facilities in relation to your specific requirements, send us your detailed blueprints. Your inquiry will receive prompt attention.

# SPEER

*Carbon Co.*

CARBON PRODUCTS DIVISION  
ST. MARYS, PENNSYLVANIA

### Products of the Carbon Products Division include:

Brushes for Motors & Generators • Carbon & Graphite Specialties • Electronic Tube Anodes • Flash-light & Battery Carbons • Plates & Rods • Rocket & Missile Components • Ultra Pure Graphite

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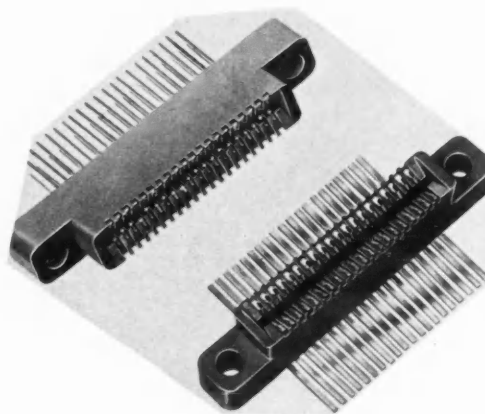
## ELECTRICAL

### Silicon-Controlled Rectifiers 311

Low-current SCR's in double-ended housings permit point-to-point wiring in a wide variety of circuits. The studless components are offered in seven models and have been assigned JEDEC designations of 2N1929 through 2N1935. They differ by repetitive peak reverse voltage ratings which range from 25v for the 2N1929 to 300v for the 2N1935. D-C load current rating is 1.1 amps.

General Electric Co., Rectifier Components Div., W. Genesee St., Auburn, N. Y.

### Microminiature Connectors 312



Series 600-2 printed-circuit connectors are small, precision-designed card receptacles for micro-electronic applications. Forty contacts with a 0.050-inch center-to-center spacing are mounted in only 1-11/16-inch-long molding. Contacts provide coil spring-action grip over entire contact area of printed-circuit boards. This permits use of undersized or oversized board tolerances while maintaining low contact resistance. Contacts accept a 1/32-inch printed-circuit board or tape cable. Recommended test voltage at sea level is 900 rms, current rating is 1 amp. Terminations can be soldered or welded. Illustrated are wire terminals in two positions: straight and with right-angle bend. Body material is glass-reinforced diallyl phthalate per MIL-M-19833, Type GDI-30 specifications.

Continental Connector Corp., Woodside 77, N.Y.



Saving your dollars with wire is a 60-year old habit at Union Steel. Devising ingenious ways to shorten time between idea conception and delivery, creation of *new designs* in welded wire, engineering new methods for more rapid, economical manufacture... all are routine benefits you realize when you specify Union Steel, the experienced source that *guarantees* higher quality.

Our experienced design engineers and production specialists are ready to help you save with wire. If your problem is immediate, why not phone Union Steel today?



UNION STEEL PRODUCTS CO.  
Albion, Michigan

Gentlemen: Please give us, without obligation, your suggestions for the use of fabricated and finished wire in our products.

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_  
Zone \_\_\_\_\_ State \_\_\_\_\_

☐ Please have a USP representative contact us at once. We are interested in \_\_\_\_\_

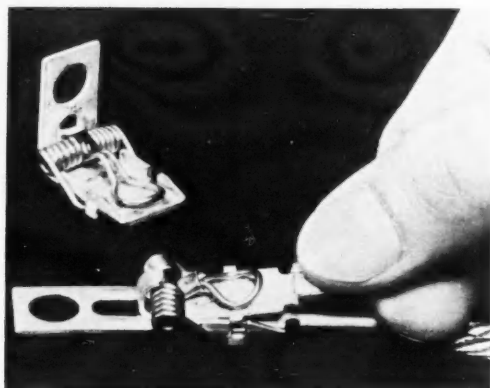
Circle 32 on Reader-Service Card

### TO-18 Case $GaAs$ Detector 313

A gallium-arsenide photovoltaic detector, in a TO-18 case, provides high sensitivity for both visible and near-infrared radiation detection. The detector is designed for the 0.4 to 0.9 micron region, having a peak sensitivity at 0.85 micron. The modified TO-18 case marks an innovation in detector packaging, providing size reduction and ruggedness. It is estimated that the GAU-401 detector is 1/20 the size of a related photomultiplier. The conventional TO-18 case has been modified with a glass window sealed at the top of the cylindrical package which measures 0.18 inch in dia and 0.20 inch in length (excluding leads). In the standard configuration, square or circular cell areas ranging from 0.2 to 4.0 mm<sup>2</sup> can be provided.

Philco Corp., Lansdale Div., Lansdale, Pa.

### Quick-Disconnect Brush Terminal 314



In the original assembly introduced early in 1960, the clip that is installed on the motor or generator was designed with a 90-deg bend. Now a straight clip is also available and is better suited to certain electrical machinery. Redesign of the clip also incorporated an improved, more positive-acting stainless-steel spring for maximum resistance stability. One of the major advantages of the assembly is that two spade terminals can be inserted in one clip, eliminating need for extra clips in many installations. For minimum electrical resistance, the clips are made of silver-plated beryllium copper and the spade terminals of silver-plated copper. Capable of carrying a continuous current of 150 amps, assemblies are designed to facilitate brush replacement on both industrial and utility equipment. When brushes are changed with the machine running, the hazard of tools or terminal screws dropping on the commutator is eliminated.

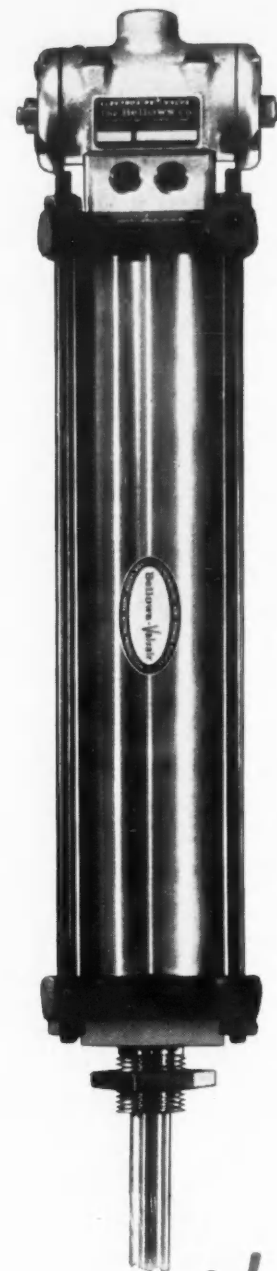
National Carbon Co., 270 Park Ave., New York 17, N.Y.

## Design with Air in Mind

The range of control systems available with the Bellows Air Motor® (the air cylinder with the built-in valve) gives the engineer a flexibility in design that not only lessens his work but enables him to build his machine at lower cost. Not only to build it at lower cost but to build it to perform more efficiently and at lower cost to the user.

Wherever a push, pull, lift or turn motion is performed by mechanical means, such as cams, gears, levers or linkages, you'll save all the way down the line—by designing with air in mind.

One of the more than 200 trained Bellows-Valvair Field Engineers will be happy to work with you in applying economical air power to your specific projects. Write today to Dept. DN-761 for Bulletins BM-25 and FP-60.



# Bellows-Valvair

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)



1104-C

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## Typical profiles of Edgewater Rolled Steel Rings



**HERE'S AN IDEA TO HELP REDUCE  
"profit squeeze"**

Buy rings that are formed so close to finished shape and dimensions that very little machining will be needed. The result—less labor, less scrap loss, lower overall cost.

Edgewater rings are forged from solid blocks of steel, and rolled by a powerful ring-rolling mill to required cross-section shapes (see typical profiles above). Close tolerances minimize finishing operations.

Edgewater rolled steel rings are of uniform quality, strong and tough. Diameters: from 5 to 145 inches. Send drawings for recommendations and prices.



INTERESTING description of the ring-rolling process is given in this brochure, **Edgewater Rolled Steel Rings**. We will be glad to send you a copy.



**EDGEWATER STEEL COMPANY**

P. O. Box 478 Dept. DN Pittsburgh 30, Pa.

Circle 34 on Reader-Service Card for more information

## MATERIALS

### Silicone Insulation

315

A silicone-rubber compound for use as wire and cable insulation is similar to the SE-975 family of compounds. The material (SE-9007) is designed primarily for high-quality aircraft, hookup, motor lead and similar wire applications. It is somewhat softer than SE-975 grade, offering excellent processing characteristics, easy milling, high extrusion speeds and very good diameter control. Life is superior to SE-975, yet physical and electrical properties are identical with the standards established by SE-975. Typical physical properties as extruded on wire are: tensile strength, 1200 psi, and elongation, 425 percent.

General Electric Co., Silicone Products Dept., Waterford, N.Y.

### Copper-Clad Epoxy-Paper Laminate

316



A new grade of copper-clad epoxy-paper-based laminated plastic for printed circuits offers high electrical properties and improvements in flexural strength, cold shearing and flame resistance. Average values of 1/16-inch-thick specimens of the base material are based on ASTM and other test methods. Flexural strength lengthwise is 25,000 psi, crosswise 23,000 psi. Impact strength lengthwise is 0.59 ft-lb/inch, crosswise 0.58 ft-lb/inch. Water absorption rate is 0.44 percent in 24 hr. With copper foil cladding, the material has a peel strength of 9 to 10 lb per inch for 1-oz cladding and 12 to 14 lb per inch for 2-oz cladding. Dip solder resistance at 500F is 15 to 20 sec. Phenolite Grade EP-492-1 is cream colored and has a dull finish. It is furnished in two sheet sizes—39 by 39 inches and 39 by 47 inches. Foil cladding is supplied in two standard thicknesses—1 and 2 oz.

National Vulcanized Fibre Co., 1061 Beech St., Wilmington 99, Del.

BENDIX-PACIFIC  
SERIES 128  
ROTARY  
ACTUATORS



FOR ENGINE  
AND OTHER OPEN AND  
CLOSED LOOP CONTROL  
SYSTEMS IN  
MISSILES AND AIRCRAFT

- ★ Outstanding power-to-weight ratio.
- ★ 100 lb. inches of torque with 70 watts output power. Weight 16 oz.
- ★ Flexibility of application with wide variety of output speeds and positions.

Contact Bendix-Pacific  
when your design requires—  
ACTUATORS

Geneva-Loc • Conventional Rotary  
Linear • High-Response •  
Safe & Arm

TIMERS

Sequential Programming  
Repeat Cycle • Adjustable

Bendix-Pacific Division  
NORTH HOLLYWOOD, CALIF.



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### Metal Repair Putty

317

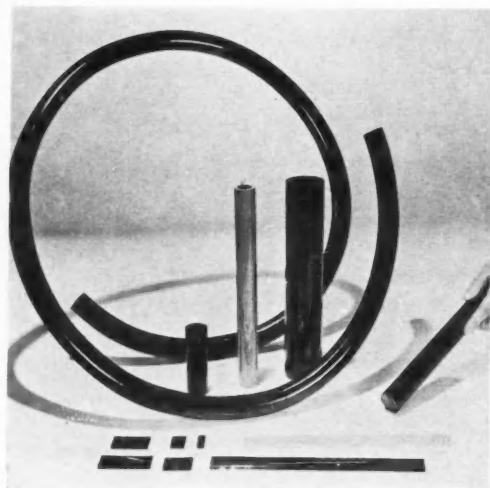
"Devcon BR", a repair compound, consists of 80 percent bronze and 20 percent plastic. Easy to use, the putty is mixed with the hardening agent supplied with each unit and then is applied. The mixture hardens in approximately 2 hr without use of heat or pressure. Once hardened, it can be drilled, ground or machined similar to metal. Its appearance after machining is similar to bronze itself. The compound bonds to iron, bronze, steel, aluminum, brass, wood, glass and many other surfaces. Tensile strength is 9000 psi; compression strength is 20,000 psi. It has high impact strength and is unaffected by oil, water and most chemicals. Shrinkage during hardening is only 0.0005 per inch. Each unit contains the hardening agent, release agent, two spoons for measuring out small quantities and complete instructions.

Devcon Corp., Danvers, Mass.

### Phenolic Extrusions

318

Commercial production of phenolic and other thermosetting plastic extrusions offers a means of continuously producing rod, tubing and other shapes of highly complicated cross-section, in any length desired. Extruded phenolic items have a fine surface finish and high gloss. Both physical and electrical properties are substantially identi-



cal with those of items conventionally molded of the same materials. The extrusions are expected to find major applications in market areas similar to those served by paper-based, phenolic laminates.

Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17, N.Y.



# BIG NEWS

The T-J Spacemaker cylinder line is not now, nor ever has been, a probe into outer space. It is offered as a practically designed, research engineered and time tested product. Its Spacemaker feature (no tie-rods) and rugged construction gives greater strength, saves space and reduces costs in all power

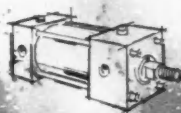
drive applications. The Spacemaker is available in a complete range of bore sizes and strokes, air or hydraulic, and contains many plus features and extras as STANDARD... NO EXTRA COST! Write Tomkins-Johnson, 2425 W. Michigan Ave., Jackson, Mich. for Bulletin #155-4 and for full particulars, today.



RIVITORS



CLINCHERS



CYLINDERS



CUTTING TOOLS

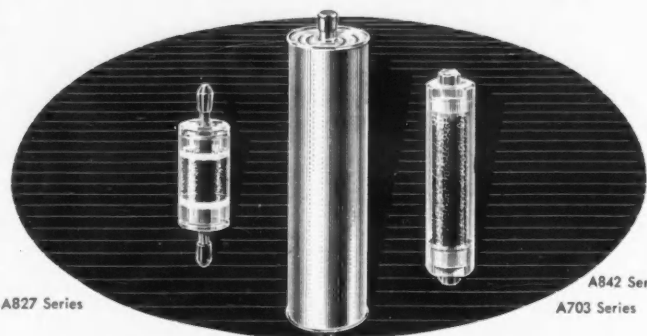
T-J

**TOMKINS-JOHNSON**

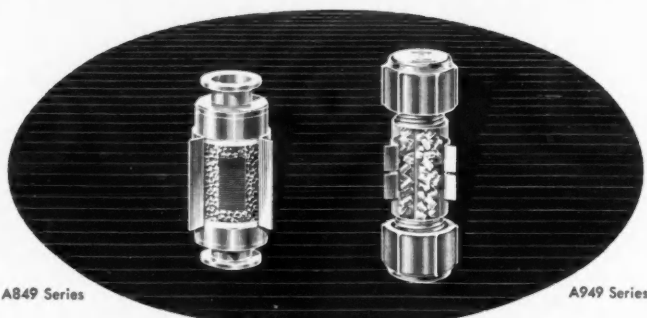
JACKSON, MICHIGAN

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# NOW! ROBBINS SMALL DEHYDRATORS FOR ELECTRONIC APPLICATIONS



**FOR INSTRUMENTS AND COMPONENTS  
PRECISION MADE FOR PERFORMANCE!**



**FOR CABINETS**

**SMALL...EFFICIENT...REFILLABLE OR THROWAWAY ELEMENTS**

Robbins Instrument Type Dehydrators and Air Purifiers are specifically designed to protect delicate sealed instruments, relays, sparking contacts and other similar components from moisture, contamination, oil vapor, fuel vapor and corrosive or explosive gases. They are connected directly in the system line. Fiberglass filter pads control downstream particle size to less than 10 microns nominal. On two models, attractive transparent Lucite housings permit desiccant material and moisture indicator to be visible at all times.

Robbins disposable type Cabinet Dehydrators are designed for static drying and purifying applications, such as in sealed electronic cabinets or boxes where it is important to guard components from moisture, humidity effects, fuel fumes and other vapor contaminants which may enter the

box when it is opened for service or inspection. They remove moisture from the air or gas in the sealed cabinet to very low relative humidity and vapor contamination level. Equipped with an indicator which shows the relative humidity condition of the desiccant and interior atmosphere. May be held in place inside the cabinet with a standard "snap in" type component clip. For cabinets that are required to breathe one model is threaded on both ends and may be screwed into a threaded port in the cabinet wall so that all air breathed in or out will pass through it and be dried and purified.



Write TODAY for 20-page illustrated brochure in color!



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Los Angeles 58, California  
LUdlow 9-5221

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## EQUIPMENT

### Miniature Electronic Tachometer 319

Providing fast reading, high accuracy and compact portability, this unusual tachometer checks both constant-speed and changing-speed equipment such as drills, presses, grinding wheels, lathes, power drives and motors. No external power source and no electrical or mechanical connections with the rotating object to be measured are required (the manufacturer states). The unit is built around a light-sensitive photoelectric cell which responds to minute illumination changes and transmits a signal to a pulse-triggered computer. In turn, the computer determines rpm and displays the result on a direct-reading meter dial. Speeds from 0 to 12,000 rpm are indicated. Calibration is simple—the tach is pointed at any fluorescent light fixture and calibration screw at bottom is turned until meter reads 7200 rpm. The



unit measures 7-1/2 by 3-3/4 by 2-5/8 inches and weighs 2 lb.

Pioneer Electric & Research Corp., Forest Park, Ill.

## DESIGN ENGINEERS

Inquire about new opportunities for highly qualified engineers in the fields of avionics, controls, electrical and electronics, empennage, equipment, fuselage, hydraulics, landing gear, power plant and wing design.

### Requires

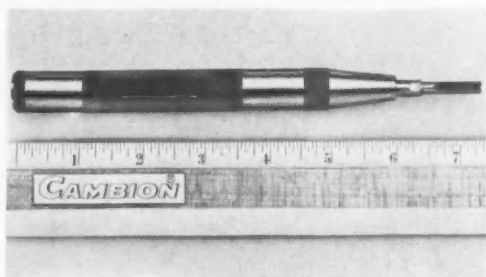
**AE, ME, EE or related degree with aircraft or missiles experience preferred.**

Combine work in an exciting professional environment with living in one of the finest cities in the country.

Write: Hugh L. Gordon, Professional Employment Manager  
Lockheed Aircraft Corporation  
841 West Peachtree St.  
Atlanta 8, Georgia

## LOCKHEED/GEORGIA

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.



A combination tool allows the user to insert and extract taper pins with one instrument. Rolled from mild steel and knurled at the handle for easy gripping, the No. 3060 tool measures 7-1/2 inches overall.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

### Miniature Magnet Gage

321

The degree of residual magnetism in steel tools, parts and structures may be determined by the "Pocket Magnetometer". The unit indicates low residual magnetism levels required for good "fuzz-free" parts cleaning. It also can measure and compare unusually strong magnetic fields by maintaining a known distance between the instrument and object being tested. A red spot on the bottom of the magnetometer case is placed near



or against the object to be tested. The pointer deflects to a reading on the scale proportional to the magnetism in the part at that point. The instrument is useful in work with hardened steel parts that are prone to pick up and retain magnetism from magnetic chucks and conveyors or magnetized machine tools.

R. B. Annis Co., 1101 N. Delaware St., Indianapolis 2, Ind.

## TYGON® Airless VINYL

### Cuts painting costs 30% to 50%

Airless spraying of protective coatings is based on the principle that liquid forced under pressure through a restricted opening tends to atomize. The garden hose and shower head are homey examples. A few years ago, it was found that paint forced through a specially shaped nozzle at pressures of 1000 psi or more, broke into millions of particles and could be deposited like a fine mist on surfaces to be painted. This new spray process made possible the use of heavier-bodied coatings with less solvents; it eliminated material "bounce-back"; it reduced overspray to a minimum. In application after application, material and labor costs were cut anywhere

from 30% to 50% over normal air spray methods.

Practically any paint can be airless sprayed. But where resistance to corrosive fumes, acid and alkali attack, are involved, it takes a coating especially formulated for airless spray application to do the job. *Tygon Airless Vinyl (Series "AV")* meets every requirement for airless spray application, plus offering corrosion-resistance properties unmatched by any protective coating. Possessing exceptional wet to dry film homogeneity, Series "AV" builds a protective film free from pin holes, even in thin films—and films of virtually any desired thickness can be built in a single application!

### CHECK THESE MONEY-SAVING . . . SURFACE-SAVING FEATURES!

#### UNMATCHED CHEMICAL RESISTANCE

Resists acids, alkalies, oils, greases, water and alcohols

#### ANY DESIRED FILM THICKNESS

Up to 20 mils or more dried film if desired, but rarely are more than 6-10 mils required

#### DRIES QUICKLY

Series "AV" dries to touch in 10-15 minutes

#### LONG SHELF LIFE

Solids remain in suspension. Minimum agitation required.

#### LOWEST APPLIED COST

Savings up to 30%-50% in labor and materials. Tygon AV Series vinyl can be applied to a 5 to 7 mil thickness in a single coat using conventional spray equipment.

#### COATINGS AND LININGS DIVISION



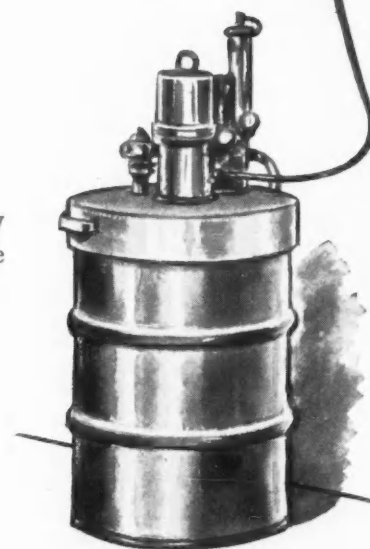
## U. S. STONEWARE

AKRON 9, OHIO

For full information  
write for Technical  
Data Sheet "AV"

NEW YORK • CHICAGO • HOUSTON • LOS ANGELES

Circle 38 on Reader-Service Card for more information





# CHR SILICONE SPONGE RUBBER SHEETS

**Flexible temperature range  
-100° F TO 500° F**

COHRLastic R-10470 silicone sponge rubber sheets have a dense, uniform, non-absorbing closed cell structure highly suitable for soft gasketing, vibration dampening, fairing strips, pads, cushions and other applications where resiliency at extreme temperatures is required. It may be bonded to metals, plastics, fabrics or silicone rubber. COHRLastic R-10470 possesses superior compression set resistance, excellent dielectric properties, immunity to aging, ozone and weather hardening.

COHRLastic R-10470 meets: AMS 3195; AMS 3196; Boeing BMS 1-23; Martin-MMS C451 and MB 6103; Scintilla 9-3143; Bendix ES-0709; Douglas DMS 1597; Lockheed LAC 1-924; Minneapolis Honeywell 6384-3 and Sperry Gyroscope P.691.764 Type HTM.

**AVAILABLE FROM STOCK:** in 12" x 12" sheets and 24" x 24" sheets —  $\frac{1}{16}$ " through  $\frac{1}{2}$ ". Special thicknesses and sheet sizes up to 30" x 30" and 24" x 48" can be made to order. COHRLastic R-10470 is sold nationally through distributors.

**CHR PRODUCTS INCLUDE:** Airframes and engine seals, firewall seals, and coated fabrics; Silicone rubber moldings and extrusions, silicone rubber sheets, silicone sponge rubber; silicone cements; conductive gasketing; and Temp-R-Tapes — pressure-sensitive, thermal curing Teflon\* Fiberglass and silicone rubber tapes.

**FREE SAMPLE and folder — write, phone or use inquiry service.**

**CHR** Leader in Fabrication of Silicone Rubber Products  
**CONNECTICUT HARD RUBBER CO.**

\*Reg. T. M. DuPont

Main office: New Haven 9, Connecticut

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DESIGN  
DESIGN IDEAS  
NEWS

MATERIALS

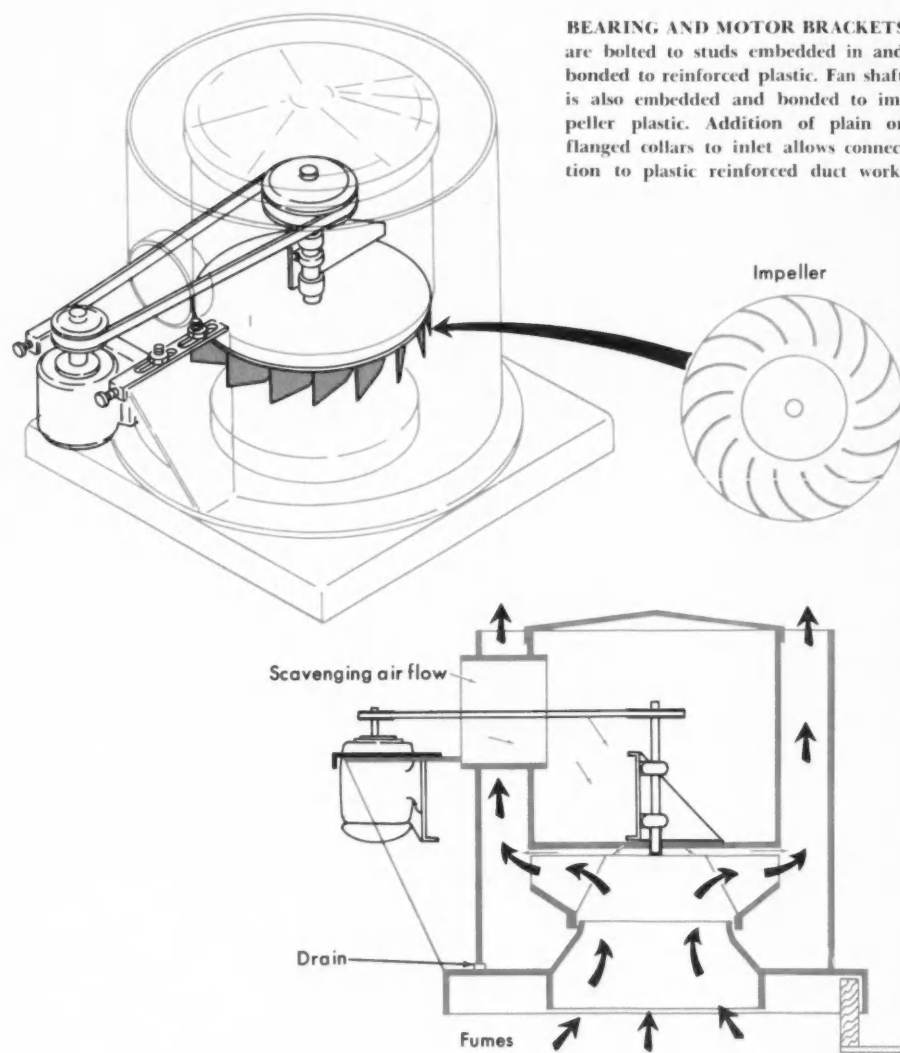
## Plastic Ventilator Parts Provide Resistance

E. J. Stefanides, Central States Editor

The housings and impellers of a new line of roof ventilators for handling corrosive fumes are fabricated of reinforced plastic. The use of this material provides tough, mechanically strong structures with good resistance to a wide range of corrosive fumes including hydrofluoric acid.

Depending on the application, any one of eight different epoxy or polyester formulations is used, each formulation com-

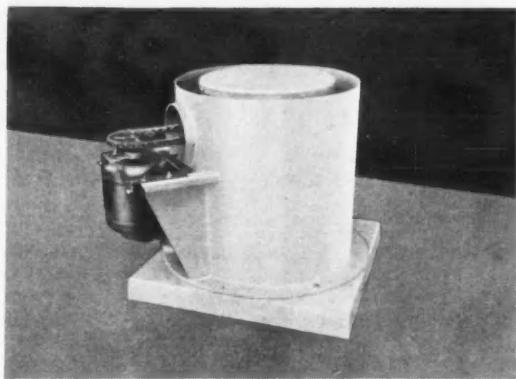
pounded to provide maximum protection against a particular group of corrosive fumes. In the majority of these formulations the thermosetting resins are reinforced with glass fibers. However, in the formulation for hydrofluoric acid fumes which attack glass, synthetic fibers such as "Orlon", "Dacron" or "Dynel" are used because of their better chemical resistance.



**BEARING AND MOTOR BRACKETS** are bolted to studs embedded in and bonded to reinforced plastic. Fan shaft is also embedded and bonded to impeller plastic. Addition of plain or flanged collars to inlet allows connection to plastic reinforced duct work.

DESIGN NEWS—JULY 7, 1961

## against Corrosive Fumes



**ROOF VENTILATOR LINE** includes sizes from 6 to 36 inches dia for air deliveries from 400 to 15,000 cfm. Ventilators are equipped with high-efficiency, backward curved blades.

Another advantage accruing from the reinforced plastic construction over the coated sheet-metal construction formerly used is the reduction of vibration. This primarily results from the non-resonating characteristics of the thicker housing material.

Mechanically, the design provides complete weather-proofing without moving parts on the exterior of the housing. It consists of a vertical-shaft centrifugal fan discharging into an axial passage between two concentric housings. The center housing encloses the bearings and pulley sheave of the fan shaft. It is supported by a large-diameter tube that is cantilevered from the outer housing and bonded by plastic welding to both housings. This tube also acts as a housing to isolate the belt-drive component from the corrosive fumes and provides easy access to the components located within the center housing.

Protection for these components also is provided by a scavenging airflow through the tube and center housing to a low-pressure area directly behind the impeller. This flow of air prevents seepage of corrosive fumes into the center housing without the use of sealing devices.

The roof ventilator is designed by the Heil Process Equipment Co., Cleveland, Ohio. It is intended for room exhausting but is designed to be adapted readily for connection to its line of reinforced plastic duct work.

# How to get a pump and motor into the smallest possible space

by E. H. Schanzlin

Chief Engineer, Tuthill Pump Company

Today's designer faces stringent limitations on space and weight in more and more of his assignments. Miniaturization is the order of the day. Even if we exclude rockets, missiles, aircraft and similar applications, reducing the size and weight of pump and motor combinations can result in significant savings.

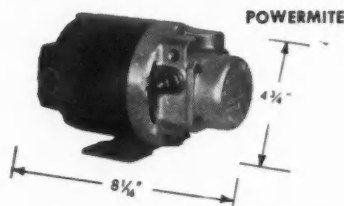
Compactness simplifies assembly operations . . . lowers production costs. Reduced weight means lower shipping expense. Elimination of components such as couplings, bases and adapters can mean substantial savings. And often a compact unit can provide the only feasible answer to a tough design problem.

## Special Combinations Developed

Five years ago, Tuthill's engineering department initiated a special program to develop compact pump and motor combinations to provide the greatest possible savings in space and weight. The units on this page, plus others in our stock and on the drawing boards, are a result of this intensive and continuing program.

## Powermite for OEM

For original equipment applications involving substantial quantities, Tuthill's engineers have developed a special design in which the pump and motor are combined in one unit which takes up no more space and

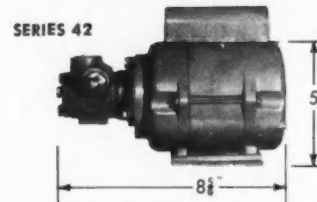


weighs no more than a standard electric motor. The typical Powermite above, used in a hydraulic application, has a capacity of 16 gph

at 350 psi despite its small size. Each Powermite is specially designed to meet the exact requirements of a specific OEM application.

## Standard Units from Stock

In addition, Tuthill provides a wide selection of standard combinations immediately available from stock. Unlike the Powermite, the stock combinations can be furnished in single units, or any desired quantity.



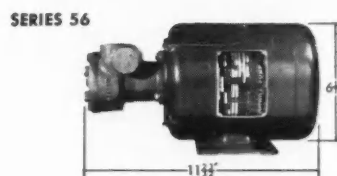
Here is a typical combination . . . series 42 totally enclosed ball bearing motors supplied with ratings from 1/12 to 1/6 hp, in combination with pumps with capacities of 20 to 45 gph at pressures to 200 psi.

## Series 48 Combinations

A selection of series 48 combinations are normally supplied with totally enclosed fan-cooled motors of either split phase, capacitor or 3 phase construction, with ratings from 1/4 to 1/2 hp. Pumps supplied in these combinations range from 20 gph to 360 gph at pressures to 360 psi. A typical combination measures only 7 5/8" x 10 7/16".

## Series 56 Units Available

Series 56 units measure 6 11/16" x 11 23/32" as shown. They are offered in a complete range of motors from 1/4 to 1 hp . . . which can be coupled



with pumps with capacities from 20 to 360 gph at pressures to 500 psi.

## Many Others Available

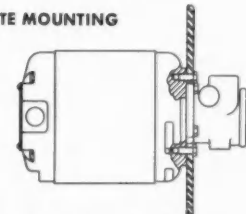
Many other pump and motor combinations are available with capacities up to 50 gpm and for pressures to 500 psi. A new selection of closed coupled units will soon be offered with motor ratings to 5 hp.

Motors are normally furnished for 1725 rpm. However, they are usually available for 3450 and 1140 rpm as well. Explosion proof construction and double shaft extensions on motors are also furnished. Built-in relief valves and other modifications are optional.

## Special Flange for Plate Mounting

For many applications a special mounting for close-coupled pump-motor combinations offers distinct advantages. Shown below, it allows the pump and motor to be mounted on any plate of sufficient thickness to bear the weight of the unit, by simply cutting a circular hole of sufficient size to allow the passage of the pump. It is particularly convenient for mounting on tanks, where it greatly simplifies piping arrangements. Through elimination of mounting flanges it further reduces space and weight.

## PLATE MOUNTING



## Send Us Your Problem

In addition to these, Tuthill has developed a wide range of solutions to special problems involving pump-motor combinations. If you are trying to fit a pump and motor into a small space, take advantage of our experience. Write and give us the details.

*Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1/3 to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.*



**TUTHILL PUMP COMPANY**

943 East 95th Street, Chicago 19, Illinois



Circle 40 on Reader-Service Card for more information

## Shock Factors for Impact Loads

William Griffel, P. E.,  
Picatinny Arsenal, Dover, N. J.

If it is assumed that stresses due to impact are distributed throughout an elastic member exactly as in static loading, then vertical deflection  $d_i$  and stress  $S_i$  produced in the member (bar, beam, etc.) by the vertical impact of a body falling from height  $h$  are greater than deflection  $d$  and stress  $S$  produced by the weight of the same body applied as a static load, in the ratio:

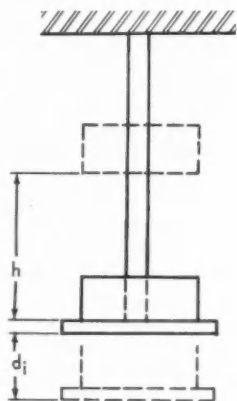
$$\begin{aligned} d_i/d &= S_i/S = 1 + \sqrt{1 + 2(h/d)} \\ &= F \text{ (shock factor)} \end{aligned}$$

If  $h = 0$ , we have the case of sudden loading, and  $d_i/d = S_i/S = 2$ , as usually assumed.

In terms of velocity  $V$  (inches per second), independent of direction:

$$\begin{aligned} d_i/d &= S_i/S = \sqrt{V^2/(384.6)d} \\ &= F \text{ (shock factor)} \end{aligned}$$

where, as before,  $d$  is static deflection (inches) which would be caused if the falling weight were applied slowly.

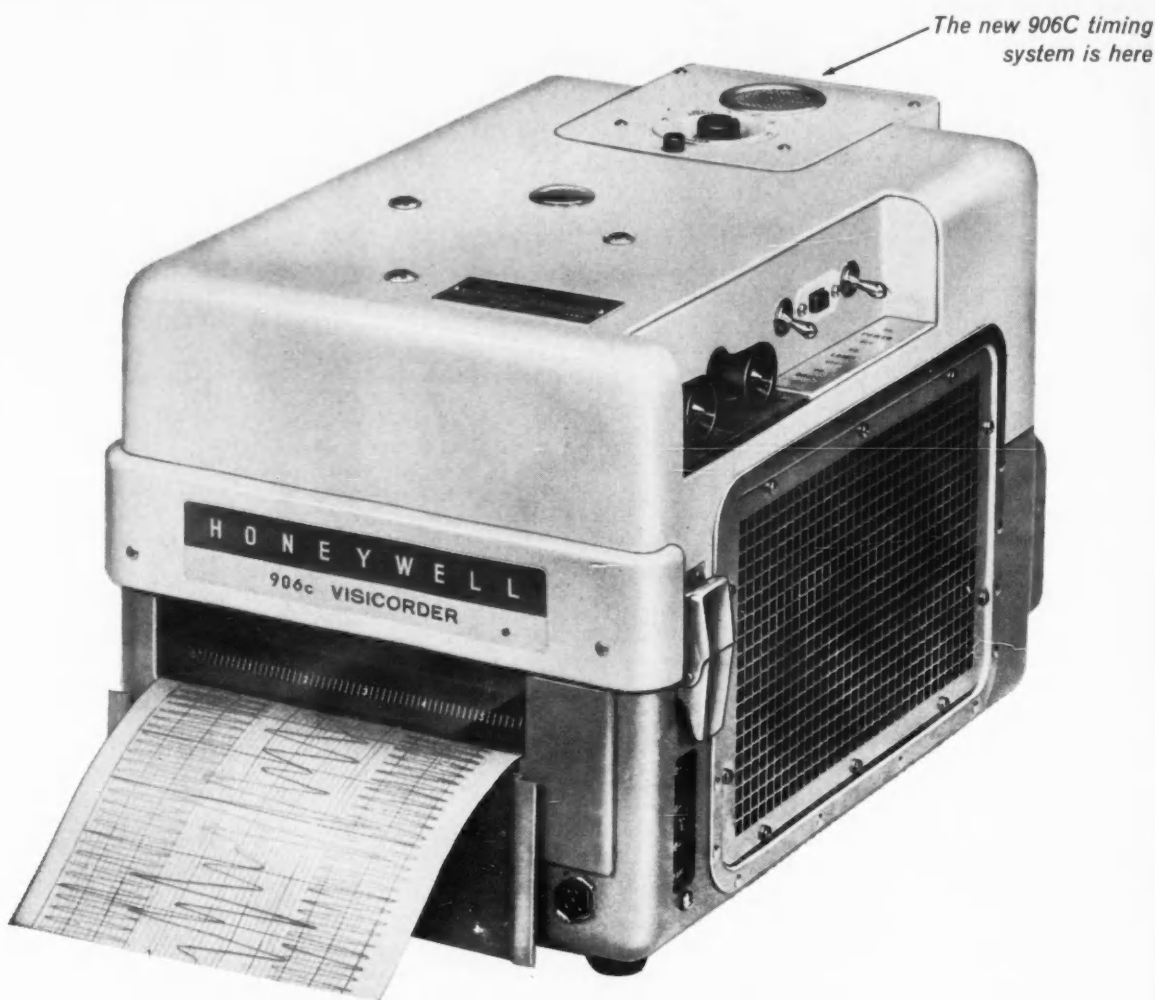


Nomogram I is for shock factors calculated for various static deflections and free-fall heights:

$$F = 1 + \sqrt{1 + 2(h/d)}$$

Nomogram II is for shock factors calculated for the same static deflections as in Nomogram I, but for a specific velocity in place of free fall.

Deflection and stress that would be caused by the impacting load if it were applied statically, multiplied by the shock factor, gives deflection and stress resulting from impact.



## What's different about the NEW 906C VISICORDER OSCILLOGRAPH?

At first glance you may see no difference at all. Just the same functional lines and compact size that you have come to recognize in the Visicorder.

They have not changed since 1956, when the Visicorder principle of oscillography made immediate readout of high frequency data possible for the first time.

Until now, all the improvements that have maintained the Visicorder's record of leadership have been internal:

- increased capacity to 14 channels
- higher frequency response (0-5000 cps)
- simultaneously recorded grid lines
- self-starting lamp for remote operation

But the 906C has a new feature you can see, (look carefully at the back of the case) and one that represents still another breakthrough; a built-in flash tube timing system which not only generates its own time base, but which can also be triggered externally. You can, in other words, use the 906C's

timing system to record time lines simultaneously with data. Or you can trigger the timing circuit externally—either by supplying a pulsing voltage of only +10v into 20K ohms impedance, or simply by causing impedance to drop to 100 ohms or less through shorting-out or other means.

Thus your "time" signal may actually be an event marker related to shaft rotation, belt movement, or any other effect which might be more conveniently fed to the timing circuit than to a galvanometer.

(Owners of Visicorders 906, 906A, and 906B will be glad to know that only a *field-change* is necessary to economically and easily add this timing system to their instruments).

Write today for full information on the brand-new 906C Visicorder. Ask for Catalog HC-906C. Or call us at SKyline 6-3681, Direct Distance Dialing Code 303.

Minneapolis-Honeywell, Heiland Division  
5200 East Evans Avenue, Denver 22, Colorado

### HONEYWELL INTERNATIONAL

Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

## Honeywell

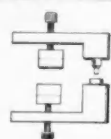
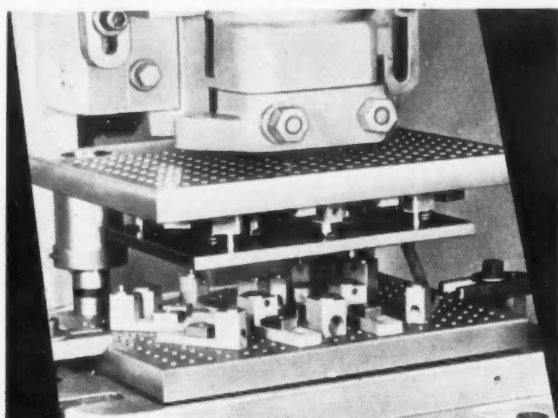


First in Control  
SINCE 1885

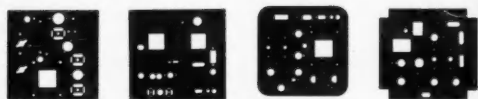
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DESIGN NEWS—JULY 7, 1961





**Punch Multiple Holes  
in One Operation  
with REUSABLE DI-ACRO  
ADJUSTABLE PUNCHES AND DIES**



Di-Acro Adjustable Punches and Dies offer you an inexpensive means of rapid tooling for multiple punching of holes of a variety of shapes and sizes. They will do the job in a fraction of the time it would take using a single station punch press and at a fraction of the cost of standard tooling. All tooling can be arranged in a countless number of patterns so that most multiple hole punching jobs can be accomplished in one operation. Tooling can be reused again and again. Holes can be as close together as  $\frac{3}{4}$ " on centers. A template locates your punches and dies accurately. All Di-Acro punches and dies are concentric, readily interchangeable. Standard rounds, squares, rectangles, ovals, D's and other shapes in a variety of sizes are available from stock.

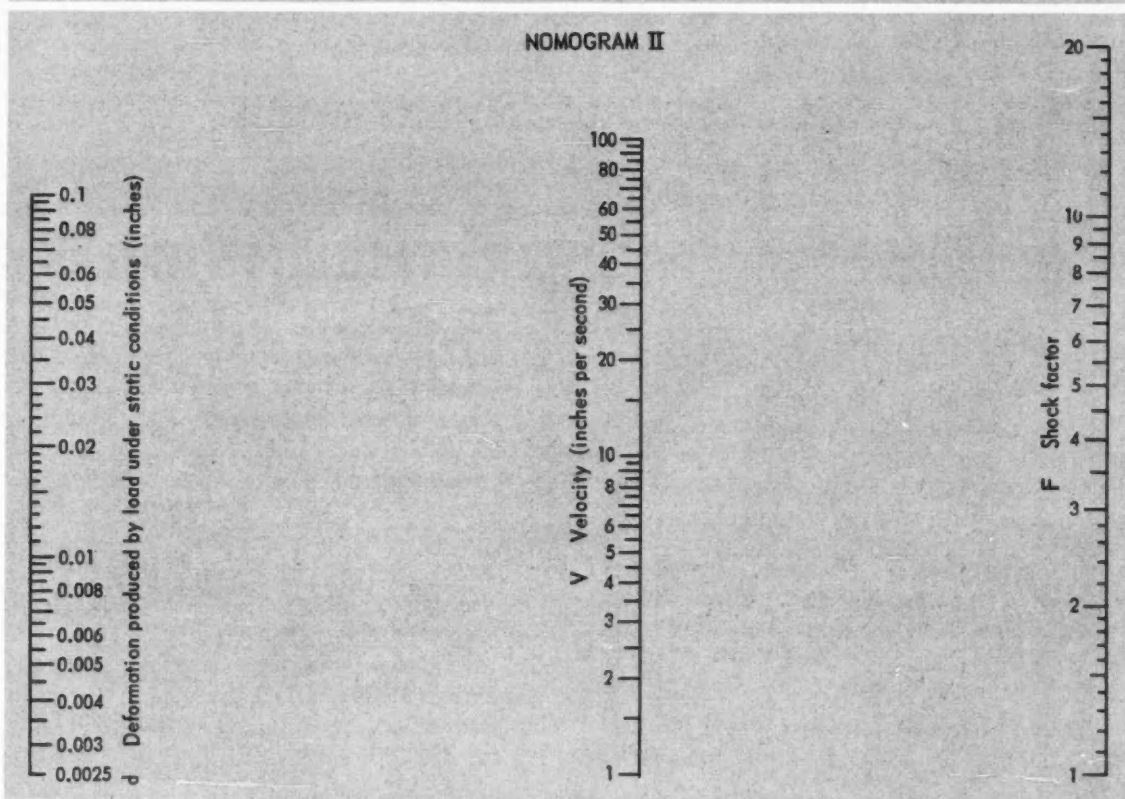
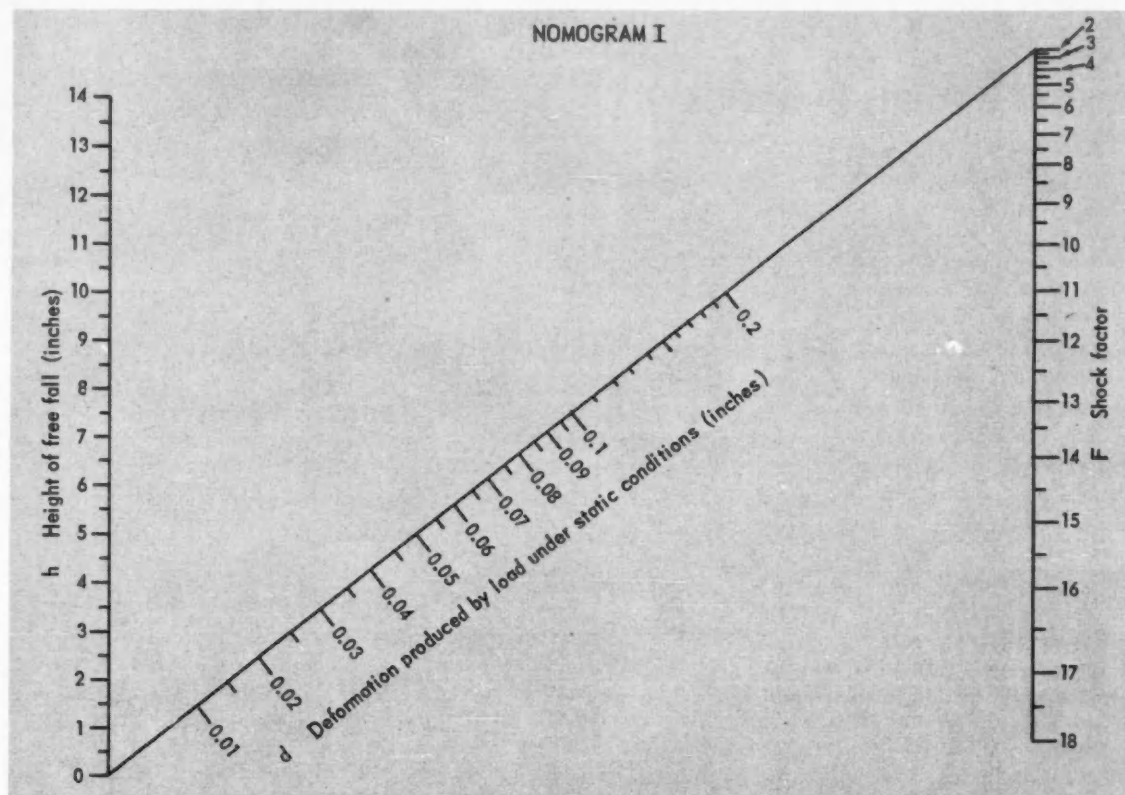
Di-Acro Adjustable Punch and Die catalog is complete with detailed instructions and prices on all die sets, punches and dies. Consult the yellow pages of your phone book for the name of your Di-Acro Distributor or write us for your free copy.

**DI-ACRO CORPORATION**

formerly O'Neil-Irwin Mfg. Co.  
357 Eighth Ave. • Lake City, Minn.



Pronounced die-ack-ro



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DESIGN NEWS—JULY 7, 1961

For Free Reprints of the Above Article, Circle 526 on Reader-Service Card

## DESIGN DATA

### Linear Springs in Series

S. Warren Kaye, West Peabody, Mass.

This nomogram will help solve many problems in dynamics, vibrations and related areas by employing any number of springs in series. Consider the system shown in Fig. 1 where a mass  $m$  is suspended from four springs  $S_1$ ,  $S_2$ ,  $S_3$  and  $S_4$ , which have spring constants of  $k_1$ ,  $k_2$ ,  $k_3$  and  $k_4$ , respectively. Assume a downward force on the mass of 1 lb. This force will be transmitted through the four springs in full strength and their respective elongations will be  $(1/k_1)$ ,  $(1/k_2)$ ,  $(1/k_3)$  and  $(1/k_4)$ . The total elongation per pound is  $[(1/k_1) + (1/k_2) + (1/k_3) + (1/k_4)]$ ; however, the following rule for springs in series applies: for "n" linear springs in series, the spring constant  $k$  is found from the sum of  $(1/k_n)$ . In the above example  $n = 4$  springs and

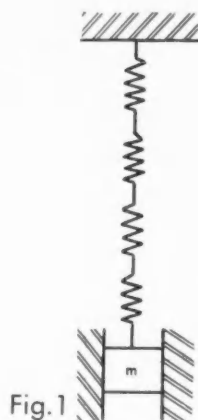


Fig. 1

$$k = \left( \frac{1}{\sum (1/k_n)} \right)$$

$$= \left( \frac{1}{(1/k_1) + (1/k_2) + (1/k_3) + (1/k_4)} \right)$$

Nomenclature:

$k$  = linear spring constant, lb/inch deflection

$P$  = load, lb

$\delta$  = deflection, inches

Example: Determine the linear spring constant for four springs in series if  $P_1 = 100$  lb,  $P_2 = 500$  lb,  $P_3 = 750$  lb and  $P_4 = 1000$  lb, and  $\delta_1 = 0.01$  inch,  $\delta_2 = 0.02$  inch,  $\delta_3 = 0.025$  inch and  $\delta_4 = 0.04$  inch.

Solution: Because  $k = (P/\delta)$ , then  $(1/k) = (\delta/P)$ . Align values of  $P$  (left-hand scale) with corresponding values of  $\delta$  (right-hand scale) and read values of  $(\delta/P)$  on  $(\delta/P)$  scale:

$$(\delta/P)_1 = 0.0001$$

$$(\delta/P)_2 = 0.00004$$

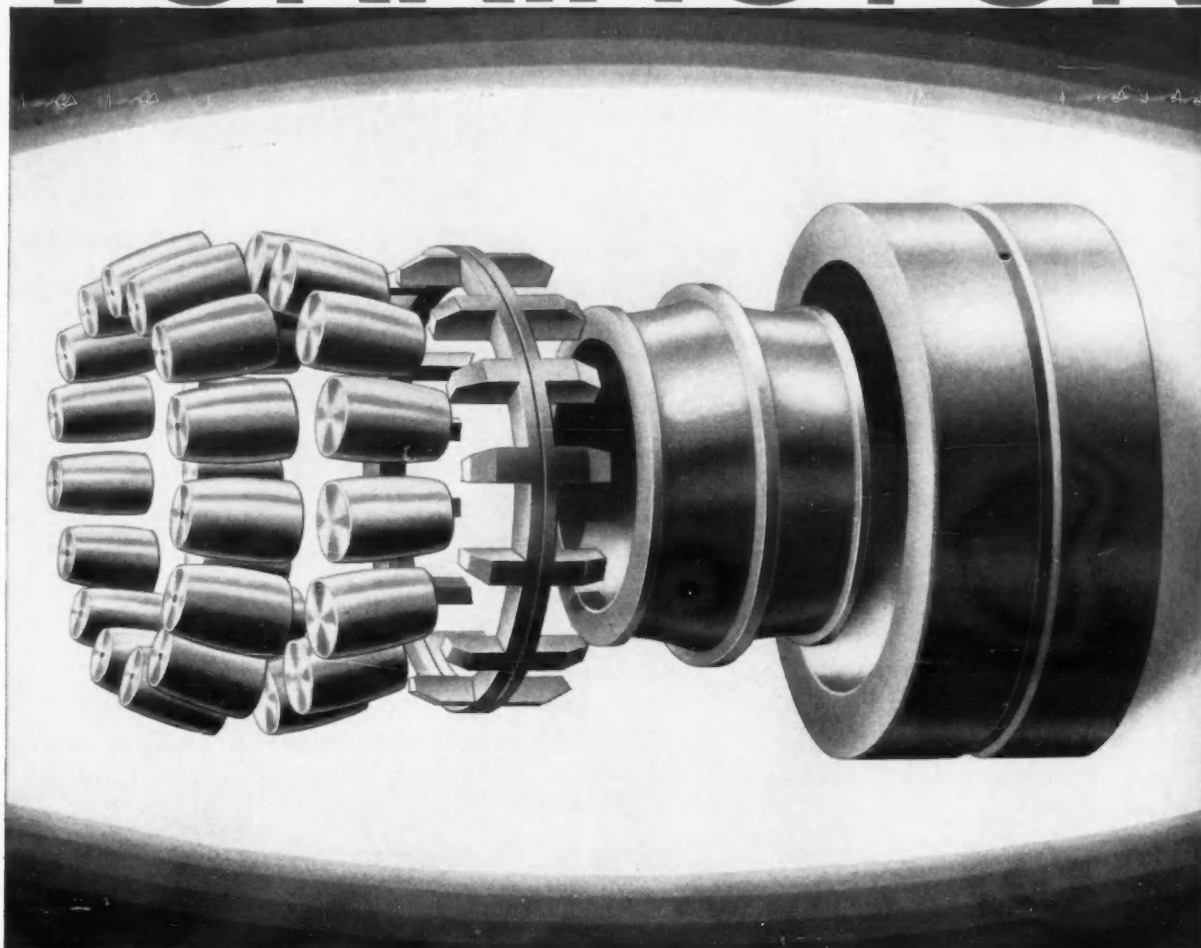
$$(\delta/P)_3 = 0.000033$$

$$(\delta/P)_4 = 0.00004$$

$$\sum (\delta/P) = 0.000213$$

Align sum of  $(\delta/P)$  values on  $(\delta/P)$  scale with Reference point on back of  $P$  scale, intersecting  $k = 4695$  lb/inch deflection.

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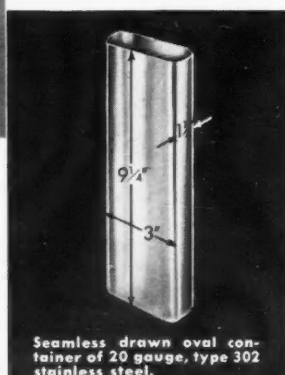
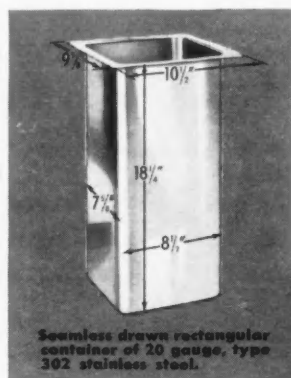
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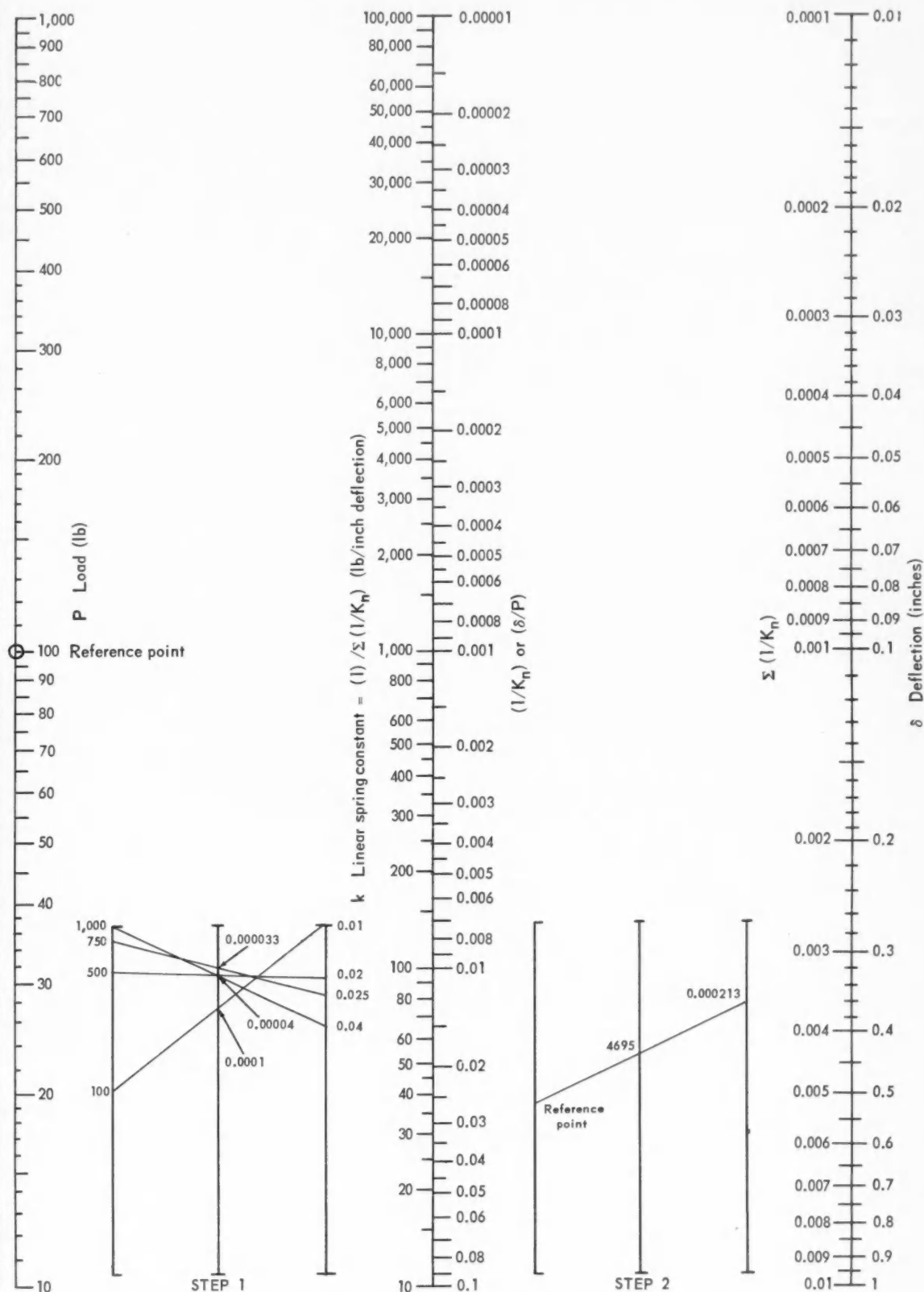


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## NEW LITERATURE

### Time Controls

451

"Basic Timing Instruction Manual" starts with an elementary explanation of time controls and circuitry and progresses to complex application diagrams. The 70-page manual is intended as a beginning text for rapid understanding of basic time control principles and applications. Among specific subjects covered are: basic construction of time controls, a simplified explanation of switches and circuits, the function and operation of elapsed-time indicators, cycle timers, interval timers, time-delay timers and a new line of "Acrotimer" reset timers. Haydon Div., General Time Corp., Torrington, Conn.

### Tap Selector

452

Describes a new tap selection idea, based on a series of detailed tap-use field studies. The Color-Keyed Tap Selector Program is designed to take advantage of sound marketing principles, particularly use of a color-coding method to simplify the specification of the proper tap in 75 percent of all tapping applications. Basis of the system is a master chart. In addition to the chart, the 60-page manual includes specific tap size application data, basic tap information as to tap functions, sizes, styles, standards and drill-size selector charts. A "trouble-shooting" chart gives cutting characteristics of various metals, tap recommendations, makes lubrication suggestions and discusses tapping problems and possible solutions. Besly-Welles Corp., South Beloit, Ill.

To obtain copies of numbered literature . . . circle appropriate number on Reader-Service card.

### Tracing, Master Material Samples

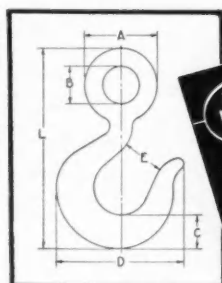
453

Samples include "Duratrace" drafting film—a tough, untearable polyester film; "Ozatrace" tracing vellum—100 percent rag paper made transparent by a resin; "Drafrace" tracing vellum—a 100 percent rag paper treated with a resin transparentizer; "Drafrace" with nonreproducing grid; "Visi-Tran" tracing paper—an imported transparent paper; "Ozatran" tracing paper—a 100 percent rag natural tracing paper; "Ozamaster" translucent bond for fast, sharp diazo copies; "Trans-Econ" translucent parchment with fast repro speed; "Transalid" master sets, "Ozamaster" and opaque orange carbon paper in a snap set; and translucent rag analysis pads, regular accountant's columnar forms on translucent paper. Ozalid, a Div. of General Aniline & Film Corp., Johnson City, N.Y.

### Sintered Titanium

454

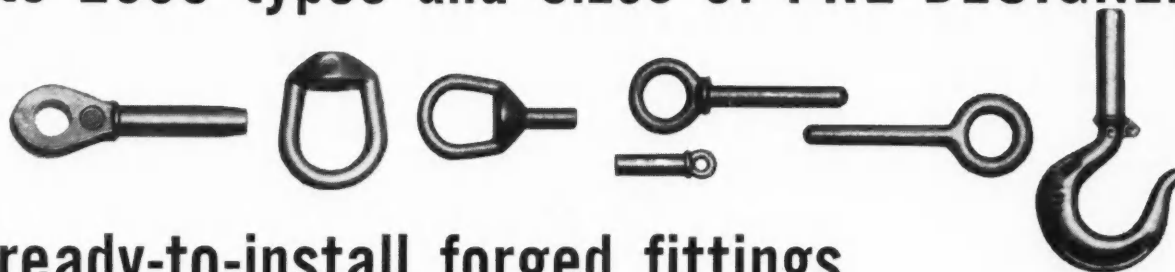
Pinpoints cost-saving potentials of sintered titanium in modern design. Bulletin No. 100, four pages, presents basic design information and properties for sintered titanium, including tolerances, processing and specifying data and technical service information. Some of the benefits derived from use of sintered titanium as a design material are outlined: strength-to-weight ratios up to 300 percent higher than stainless steel, 200 percent reduction in thermal expansion over aluminum and nearly unmatched environmental resistance. Clevite Corp., 540 E. 105th St., Cleveland 8, Ohio.



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#### High-Speed Photography 455

High-speed photography, what it is, where it is used and what it has accomplished are explained in this four-page folder. High-speed "Fastax" cameras are illustrated and an explanation of how the cameras work is included. Wollensak Optical Co., 850 Hudson Ave., Rochester 21, N.Y.

#### Ceramic Blanks and Tools 456

A 48-page easy-to-use price list on carbide blanks and tools, carbide and ceramic inserts, "Tantung" cast-alloy tools, toolholders and face mill cutters. Catalog VR-58 also contains detailed charts covering product dimensions, part numbers, grades stocked, standard package quantities, base prices and maximum catalog quantities. Vascoloy-Ramet Corp., Waukegan, Ill.

#### Electron-Tube Application Notes 457

For new and experienced electronic engineers, this 58-page brochure reviews many of the do's and don't's of tube applications in the entertainment and industrial electronics fields. Chapters in the literature cover electrical considerations, detriments, design for production, general application information, notes on specific applications, mounting and environments. Sylvania Electric Products, Inc., 730 Third Ave., New York 17, N.Y.

#### Radioactivity Measuring Instruments 458

Describes more than 250 instruments, counting systems, radionuclides and nuclear accessories. Catalog S, 96 pages, includes automatic sample changers for beta and gamma samples on large-diameter planchets or in test tubes; manual and automatic liquid scintillation detectors; integrated, modular research-type instrumentation with inline digital readout of time and count; laboratory monitor, both a-c and battery-operated; improved scintillation detectors; neutron generators, radioactivity training systems for students, license-exempt radionuclides for training purposes and personnel protection devices. Nuclear-Chicago Corp., 333 E. Howard Ave., Des Plaines, Ill.



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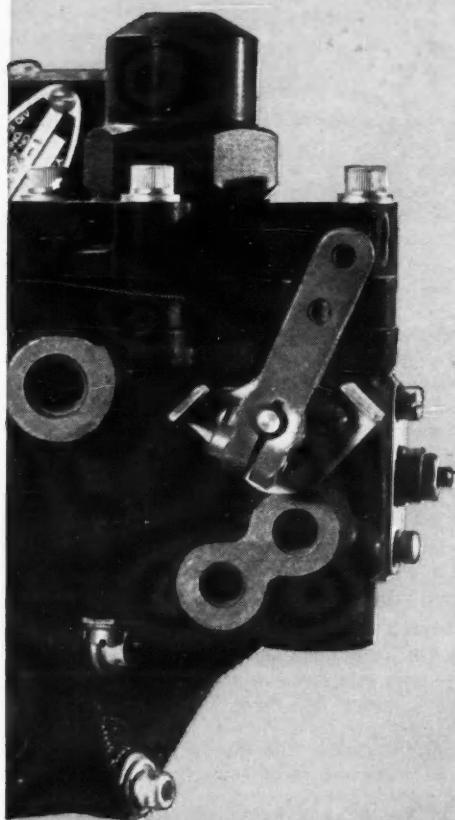
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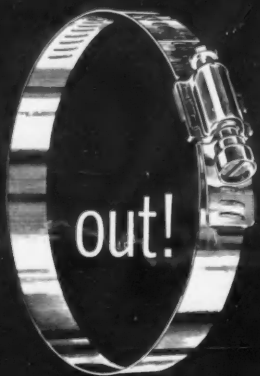
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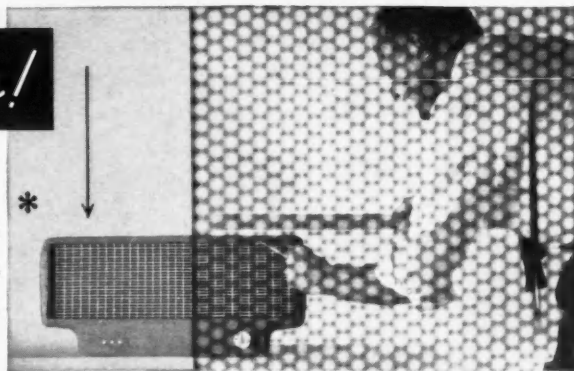
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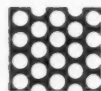
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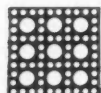
\*Product Development by William M. Schmidt Associates.



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#### LITERATURE

##### Solenoid Valve Selector

459

Contains all necessary information for quick, accurate selection of the proper solenoid valve for particular applications. Bulletin S1-1 gives specific data regarding size, pressure, temperature, coil type, special features and assemblies, condensed to aid proper selection. The last page of the four-page bulletin shows Cv flow factors used for quick and accurate sizing of valves. J. D. Gould Co., 4707 Massachusetts Ave., Indianapolis 18, Ind.

##### Controls

460

Brochure SED 100 shows how equipment can be created to simulate control, or monitor transient, static or dynamic conditions in a planned or random sequence. Descriptions of eight illustrated types of equipment outline their function and capabilities. One section of the six-page brochure explains how the company's integrated facilities enable development of unique systems for precision control, operation, monitoring and testing of military and industrial equipment. Meriam Instrument Co., 10920 Madison Ave., Cleveland 9, Ohio.

##### Expanded Metals

461

Illustrates 38 decorative expanded metal designs (at actual size) and gives specifications of each as to weight, dimensions, percentage of open area and materials available. Sections of Catalog 61 cover trade terminology, metals expanded, finishes, fabrication, ordering information and illustrations and specifications of commercial meshes and gratings. The 36-page brochure should be a valuable source of expanded metal data to industrial designers, engineers and others in the metal-working field. Southern Electric, Inc., 8701 S. Greenwood Ave., Chicago 19, Ill.

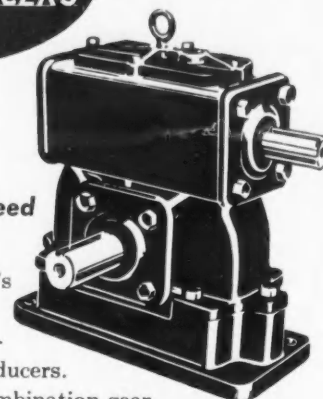


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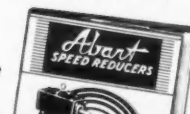
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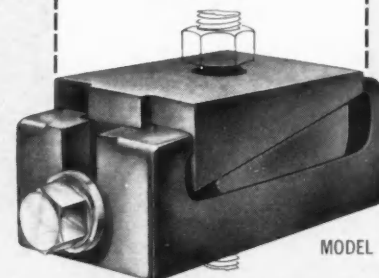


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DESIGN NEWS—JULY 7, 1961



#### Lock Washers

462

"How to Select the Right Lock Washer to Meet Job Requirements" is a basic lock-washer guide. The pocket-sized Form AS-105, 12 pages, covers a wide variety of types and styles and their major applications. A lock-washer application index in tabular form provides a valuable reference source. Shakeproof Div., Illinois Tool Works, St. Charles Rd., Elgin, Ill.

#### Cam Locks

463

Locking devices — clip locks, pin tumbler cam locks, disc tumbler cam locks, special-purpose locks and accessories — highlight Form C-61-2, 12 pages. All items are illustrated and tables of specifications are given for these locking devices for metal, wood or plastic installation. Schematics show cams available for use with various locks. Corbin Cabinet Lock Div., The American Hardware Corp., New Britain, Conn.

#### Safety and Production Equipment

464

A ready reference source book for purchasing agents, maintenance and production men contains a complete line of maintenance, safety and production equipment. Buying data cover 110 different products. Typical items in Catalog No. 33 include rotary burs and files, metal-cutting saws, test instruments, electric etchers and electric-motor maintenance devices. The 64-page brochure contains dimensional drawings, how-to-use-it photographs and complete prices. Martindale Electric Co., 1375 Hird Ave., Cleveland 7, Ohio.

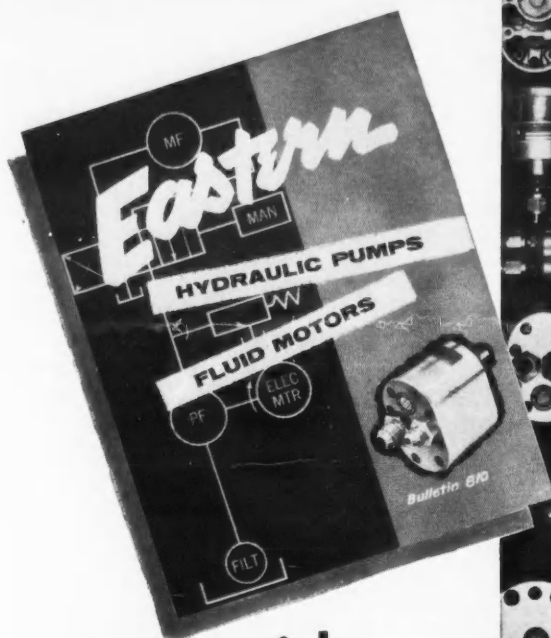
#### Precision Investment Castings

465

A revised edition of "How to Design Precision Investment Castings", this pocket-sized book has been expanded to contain new process information and case histories. Written as a guide for metalworking executives and design engineers who wish a file of benefits and limitations of the "lost wax" investment-casting process, the book also details many basic design principles as they apply to the investment-casting processes. A materials chart lists physical properties and uses of some of the popular metals. Midwest Precision Castings Co., 10703 Quincy Ave., Cleveland 6, Ohio.



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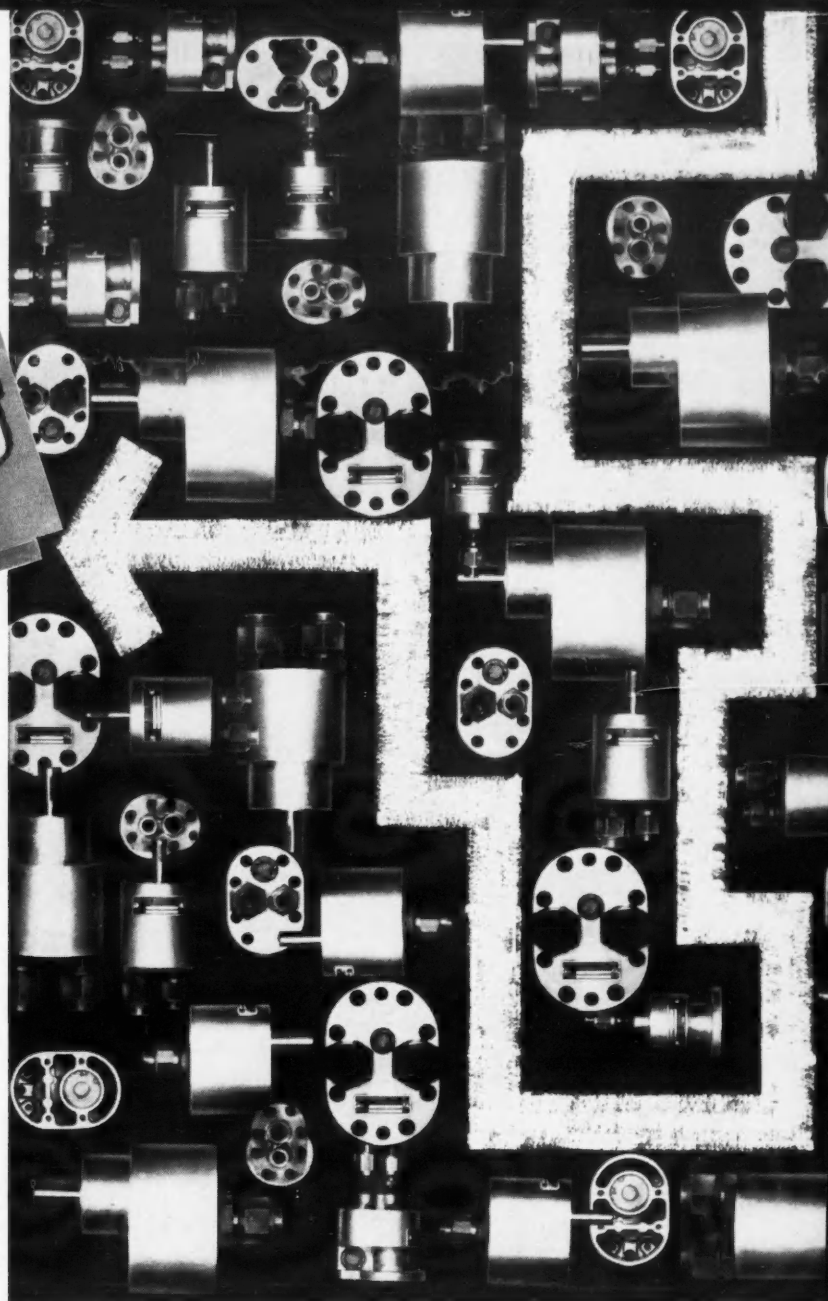
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**TECHNICAL PAPERS**

Copies of these papers may be obtained by writing to technical society indicated. Addresses follow last item.

**PREVENTION OF CORROSION IN STEAM SYSTEMS UNDER CHANGING LOAD CONDITIONS;** Marcel Stein, Illinois Institute of Technology, Chicago, Ill.; presented at The American Power Conference, 23rd Annual Meeting, Chicago, Ill.

An analysis of reasons for decreasing de-aeration effect at part load. On basis of heat and mass transfer considerations, an actual de-aerator design is evaluated critically and design criteria are given for a de-aerator working well at all load levels. Prevention of corrosion in surge tanks and de-aerator receivers and the reciprocal effects of shutdown and operating-period corrosions are discussed. Prevention of shut-down corrosion in steam systems by means of physical methods rather than by additives is proposed.

**THE GENERAL MOTORS COMFORT DIMENSIONING SYSTEM;** F. D. Kaptur, Jr., and M. C. Myal, General Motors Corp., Warren, Mich.; SAE No. 267B; \$0.75; to SAE members, \$0.50.

Human engineering principles for automobile passenger compartments and the concept of dimensioning to the human are explained. Application of design limits to two- and three-dimensional tools and the comfort dimensioning practices followed by General Motors are reviewed along with car-checking procedures.

**APPLICATIONS OF BACKSCATTER RADIATION TO NONDESTRUCTIVE TESTING;** John H. Tolani, Lockheed Aircraft Corp., Marietta, Ga.; presented at the Second Annual Symposium on Nondestructive Testing of Aircraft and Missile Components. Copies available from R. B. Wangler, Southwest Research Institute.

A general exploration of physical characteristics of backscatter measurement components. Components being investigated are source energy, source collimation, scattering angle, detector shape and location, and backscatter yield from different materials. Data are being collected to relate, in handbook form, the optimum arrangement of system parameters for measurement of specific materials. Results to date indicate a sensitivity and resolution of location better than were expected originally.

**AUTOMATIC CHECKOUT EQUIPMENT ON MILITARY AIRCRAFT;** R. G. Lohmann, PRD Electronics, Inc., Brooklyn, N. Y.; ASME No. 60-WA-330; \$1.00; to ASME members, \$0.50.

A discussion of aircraft maintenance levels in which automatic checkout equipment functions. Criteria for choosing equipment, the tactical situation, time available for the maintenance task and the overall economy of automatic checkout for a weapon system are reviewed. Application of automatic checkout in the W2F-1 and A2F-1 is described in relation to levels of maintenance.

**WHICH DRIVE—ELECTRIC, MECHANICAL OR HYDRAULIC?** George W. Younkin, Giddings and Lewis Machine Tool Co., Fond du Lac, Wis.; ASME No. 61-MD-4; \$1; to ASME members, \$0.50.

Comparative performance capabilities for electric, mechanical and hydraulic machine drives provide a means for the machine designer to select the most economical match of machine drive by its capabilities to a machine by its requirements.

**STRUCTURAL DESIGN FOR SAFETY IN HIGH-SPEED HYDROFOIL SHIPS;** Richard G. Merritt, Boeing Airplane Co., Seattle, Wash.; SAE No. 355B; \$1; to SAE members, \$0.75.

Aspects of the structural design of a hydrofoil ship which affect integrity and safety. An attempt is made to cover some phases not normally considered in the design of a conventional displacement ship.

**ADVANCEMENTS IN SUBMERGED-ARC WELDING OF HIGH-IMPACT STEELS;** R. A. Kubli and W. B. Sharav, Linde Co., New York, N. Y.; presented at the AWS 42nd Annual Meeting and AIEE Electric Welding Conference; abstracts of papers presented available in book form from American Welding Society; \$2.

How to obtain the best welds with high-impact values at 100,000-psi yield-strength levels. An investigation of results of developments on fused nonalloy-bearing fluxes or compositions for submerged-arc welding of alloy steels requiring good impact properties. Welding of T-1 and HY-80 are particular examples. Actual applications are cited with operating data.

**FACTORS IN JOINT DESIGN USING ADHESIVES FOR METAL BONDING;** H. R. Butzlaff and K. F. Charter, A. O. Smith Corp., Milwaukee, Wis.; ASME No. 61-MD-14; \$1; to ASME members, \$0.50.

Factors leading to the selection of adhesives for bonding metal and limitations of these adhesives. Data represented by various graphs indicate which elements need to be known in most design problems. Factors are frequently different from those considered in designing with nonorganic materials.

**PRESSURE-VESSEL DESIGN REQUIREMENTS IN THE FUTURE;** W. B. Carlson, United Kingdom; presented at AWS 42nd Annual Meeting and AIEE Electric Welding Conference; abstracts of papers presented available in book form from American Welding Society; \$2.

A rational design procedure for pressure vessels is detailed to draw attention to alternate procedures and to review information which would be required for these procedures. Present-day simple forms of design code, based on conventional design stresses, will probably remain in use for some time. This does not preclude formulation of more sophisticated codes intended to bring about more economic design of expensive vessels and to cater for designs and operating conditions presently falling outside established codes.

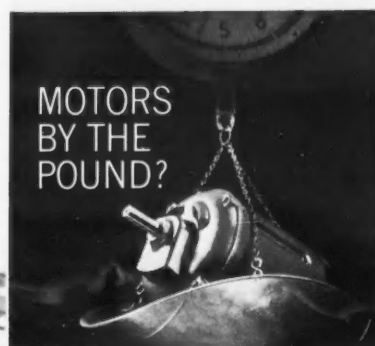
*The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.*

*American Welding Society, 33 W. 39th St., New York 18, N. Y.*

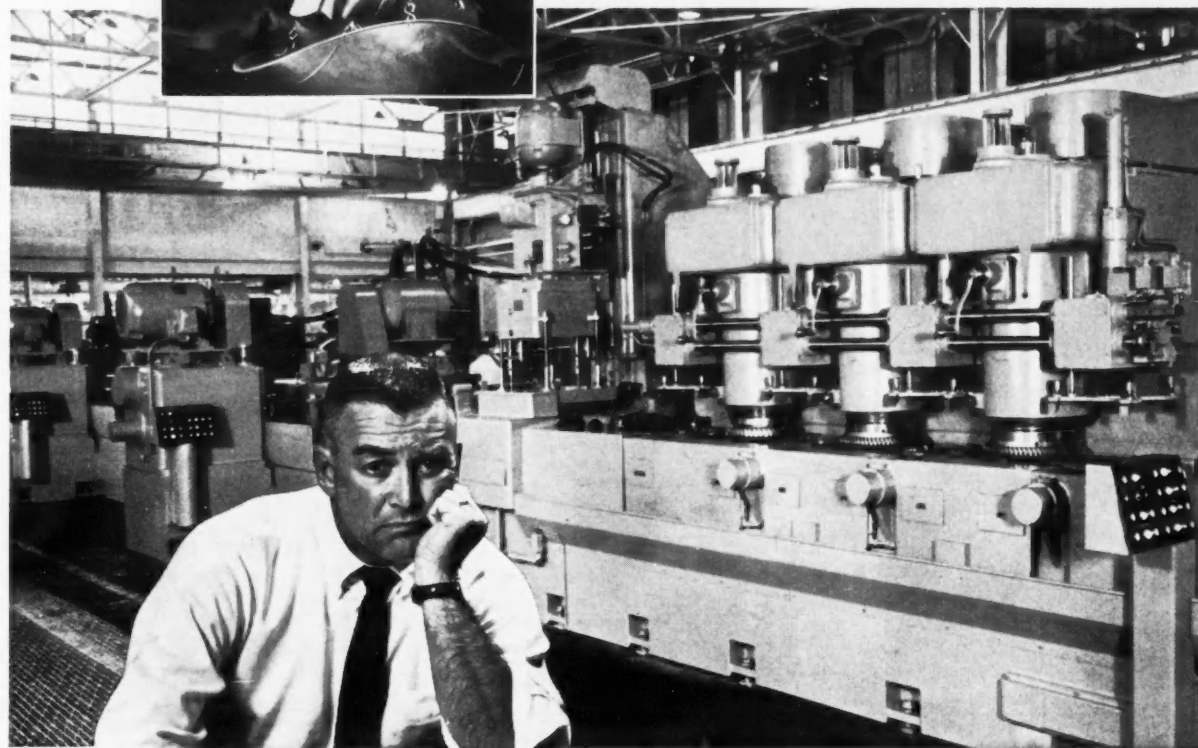
*Illinois Institute of Technology, 35 W. 33rd St., Chicago 18, Ill.*

*Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.*

*Southwest Research Institute, Box 2296, San Antonio 6, Tex.*



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## Automated production lines multiply the cost of motor failure

Automated production lines can't afford motor drives selected on the basis of price alone. For when a group of machines are linked in series, with each dependent on the preceding machine to supply it, a motor failure in the line quickly multiplies the cost of downtime.

Wagner® totally-enclosed, fan-cooled Type EP and JP motors are perfect power packages for automated lines. They are completely protected against dust, abrasives, fumes, steel chips, or filings. Both ends of these motors have running shaft seals to keep their heavy-duty bearings clean. These Wagner motors will keep your pro-

duction rates up, delivering full rated horsepower under the toughest conditions . . . staying on the job with continuous service. They have earned their reputation for proven dependability.

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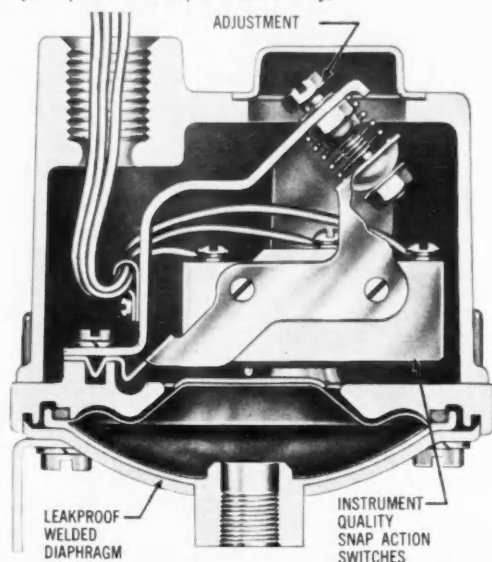
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#### EXTREME ACCURACY and DEPENDABILITY

maintained during operating life due to direct acting design

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which saves the installation costs encountered in mounting a switch that uses liquid switching elements

#### IMMUNITY TO VIBRATION

you can mount the switch directly on your vibrating or moving equipment.

#### WE DON'T USE

#### LINKAGES & BEARINGS

which, as they wear, make the setting of the pressure switch drift.

#### LIQUID SWITCHING ELEMENTS

which make the switch difficult to mount and very critical to vibration.

#### ACCORDION BELLOWS

which make the pressure switch sensitive to vibration.



PRESSURE SWITCH DIVISION



Ask for new catalog and handbook

# Barksdale valves

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## DESIGN DESIGN IDEAS NEWS

## CONTROLS

### All-Hydraulic Gang Tamber Operates through

Lars G. Soderholm, Midwest Editor

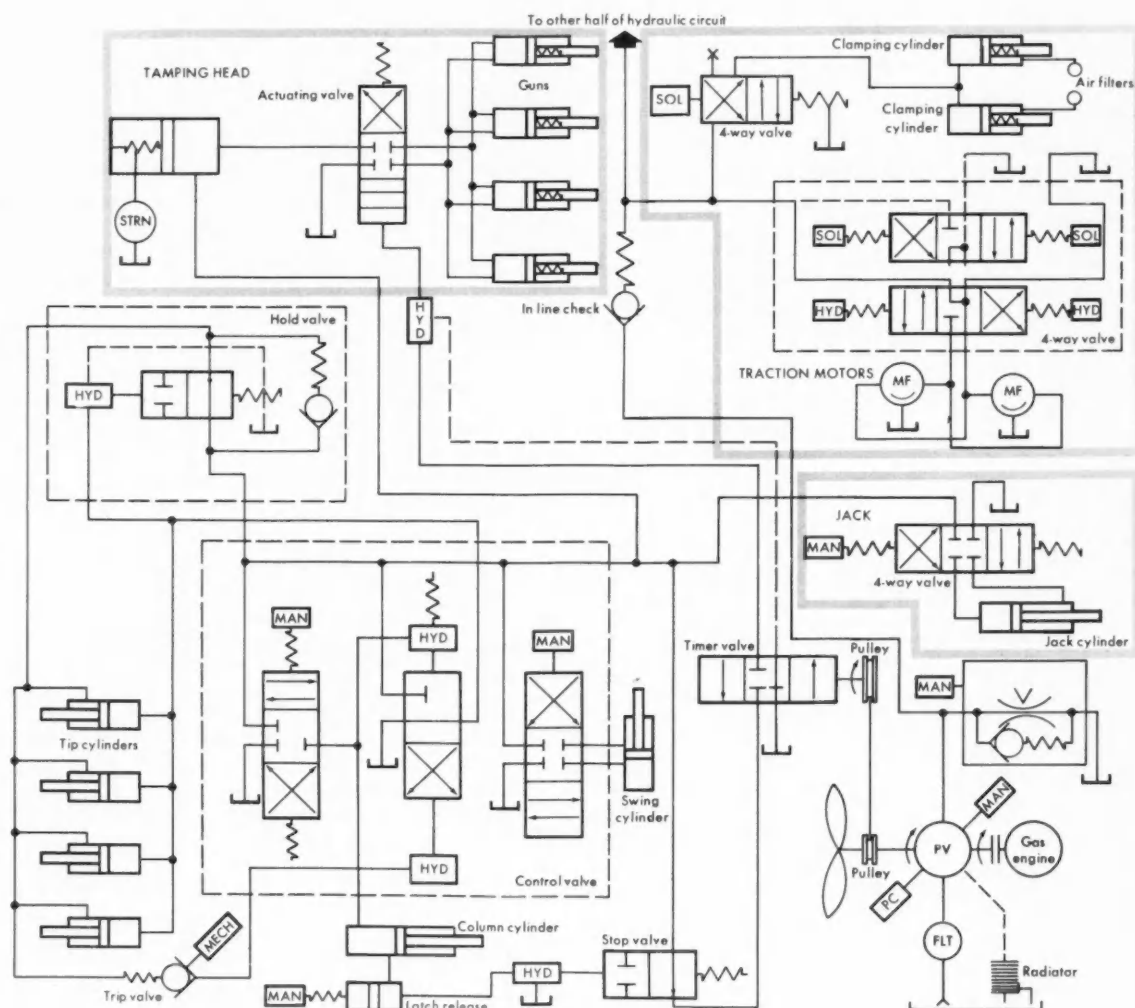
Two 18-hp gasoline engines drive two variable-volume pumps in a hydraulic system that drives a vehicle, operates and positions tamping heads, operates rail clamps and lifts the vehicle by using two attached, large-diameter jacks.

This multiple split-head tamber is unusual in that it is 100 percent hydraulically powered. Two 18-hp, four-cylinder, air-cooled gasoline engines each drive a 26-gpm variable-volume pump at 550 psi.

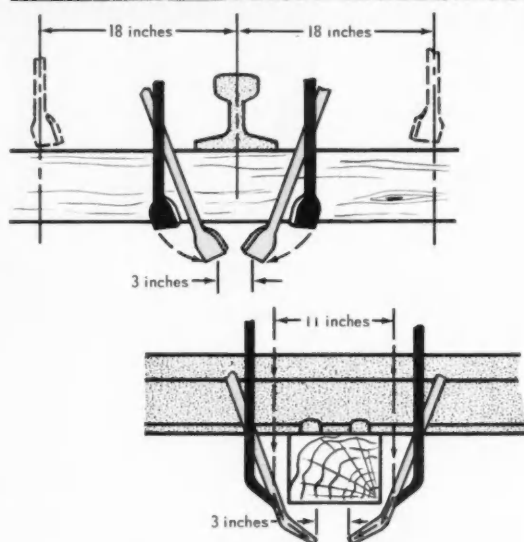
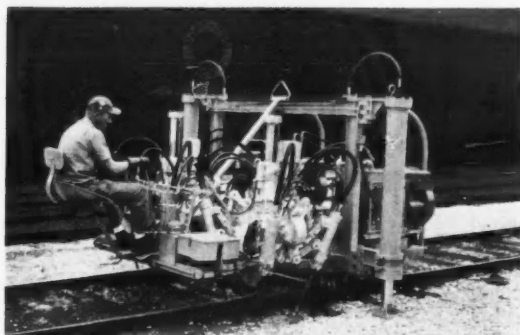
Forward motion of the 6000-lb machine is through

two constant-displacement, vane-type traction motors. These motors are controlled by a solenoid-operated valve with a foot pedal connection. Speed range is infinitely variable through a 0- to 12-mph range.

Each tamping head has four hydraulic guns in which a free-floating piston strikes the tool 1160 times a minute as a pulsating hydraulic pressure is applied. Pulsations are provided through a rotary valve that is driven from the motor fan shaft.



## Variable-Volume Pumps

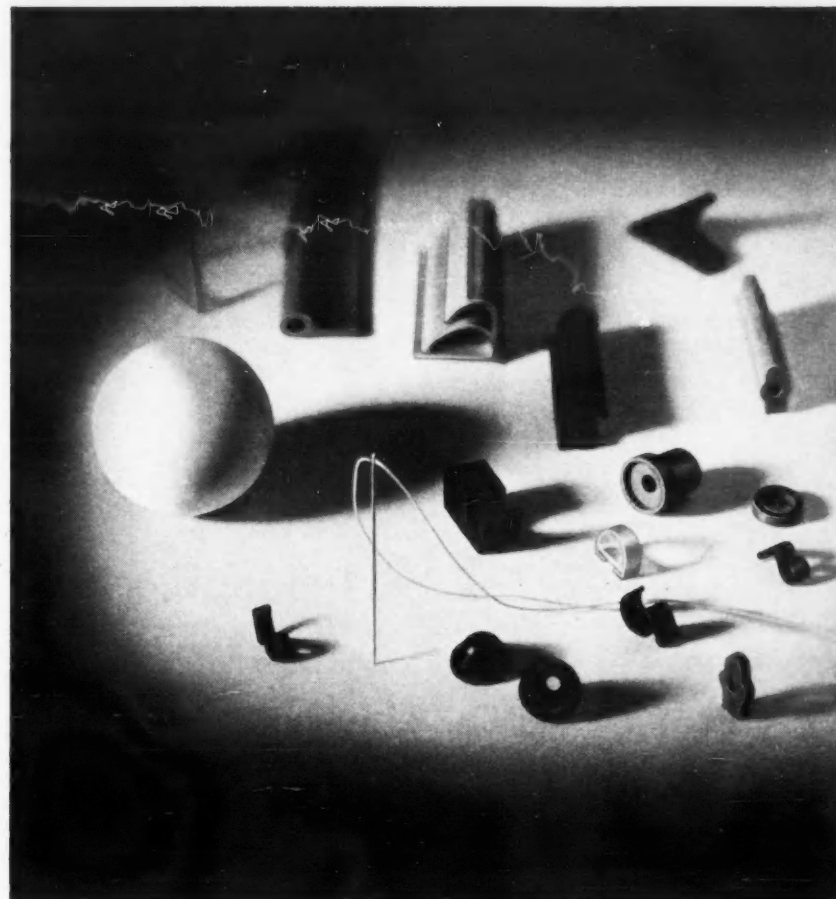


A pantograph-type linkage, positioned hydraulically, tilts the guns inward at a preset depth to tamp ballast below the rail. An adjustable tool angle, obtained through a hydraulic cylinder and a mechanical linkage, gives a choice of tamping patterns up to 18 inches on each side of the rail. Positions of the tamping heads on the column also can be adjusted as necessary.

A pair of large hydraulic jacks swing out, one on each side of the machine, for lifting loads up to 25,000 lb. Hydraulically operated rail clamps grip the rail and permit both machine and rail to be lifted as high as 24 inches above the rail base.

The "Oct-A-Gun" gang tamper is made by Racine Hydraulics & Machinery, Inc., Racine, Wis.

Years of processing rubber parts enable Garlock to practically "thread the needle" with accuracy to meet your size and tolerance requirements.



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you need  
intricate

## MOLDED AND EXTRUDED RUBBER PARTS

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Choose from a wide variety of rubbers, each carefully chosen and processed to meet your exacting needs. SBR for general use ... Natural Rubber for high

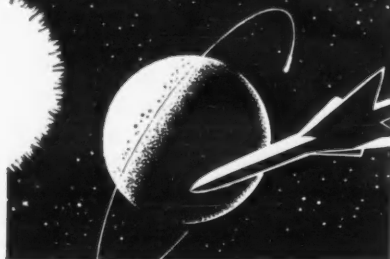
tensile strength ... Neoprene for oil and abrasion resistance ... Silicone Rubber for high and low temperature service ... Viton\* Rubber for extreme temperature and solvent resistance ... Nitrile and Butyl compounds where their special qualities are required. Your Garlock representative is fully qualified to assist you in selecting the proper material. Call him at the nearest of the 26 Garlock sales offices and warehouses. Or, write for Catalog AD-167, Garlock Inc., Palmyra, N. Y.

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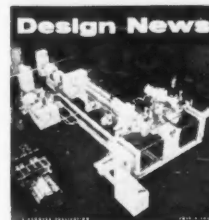
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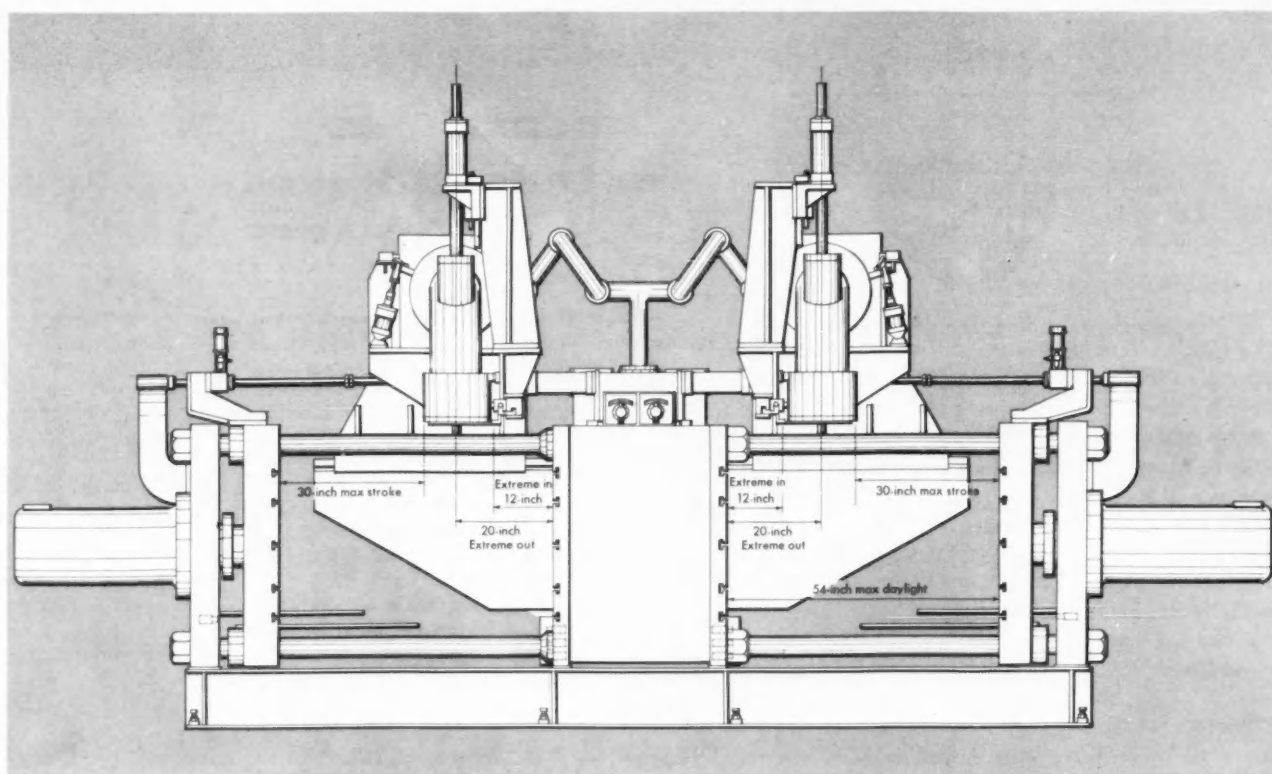
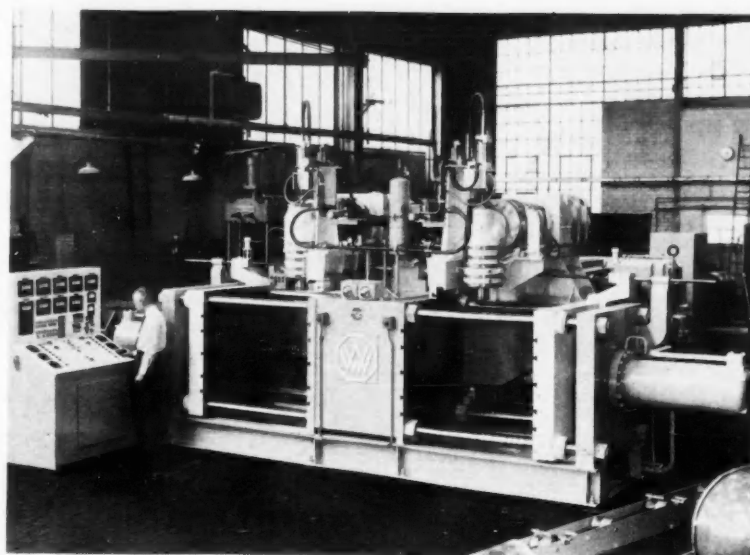
## DESIGN IDEAS IN THE NEWS NEWS



### Blow-Molder Releases 50-Lb Polyethylene Charge in 8 Sec

MOLINE, ILL.—A blow-molding machine uses two separate mold areas alternately to produce large blow-molded polyethylene parts. This huge machine has a single 8-1/2-inch-dia, 1800-lb-per-hour capacity extruder to feed two 12-inch dia accumulators—each capable of holding 50 lb of material with 0.95 density. Pressure in the accumulator then discharges the plastic at a rate of 6-3/4 lb per sec between the mold halves where the part is formed.

Each mold area consists of a stationary mold half and a movable mold half, both mounted on 50- by 50-inch square platens. The machine has a maximum clamp stroke of 30 inches and a capacity of 80 tons. As each mold section opens and closes, a movable carriage on which the accumulator cylinder assemblies, die head, knife and nozzle cylinder are mounted maintains its position directly in the middle of the two mold halves. This is done through a rack and pinion arrange-







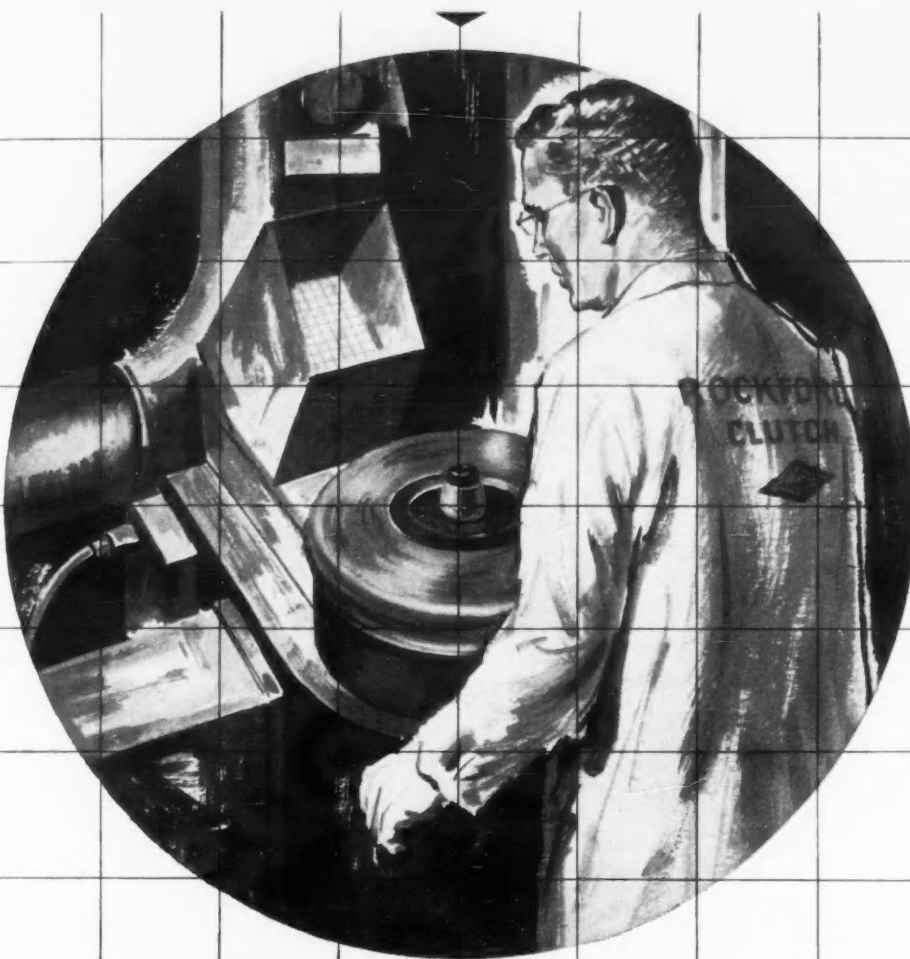
ment so the carriage, moving on recirculating roller bearings, travels at exactly half the speed of the moving mold half.

In operation the extruder feeds heated plastic into the accumulators through swivel connections. In the accumulators pressure is developed to extrude a hollow tube of plastic through the die head and between the die halves. The die or mold closes on the plastic tube, sealing the ends. An air nozzle then extends down into the mold and blows the polyethylene out against the chilled mold sides where it hardens.

Because blow molding does not require the high pressures of injection molding, mold costs are much less and the parts can be produced much cheaper. The technology of molding large shapes has been slow, primarily because the lack of satisfactory material. Linear high-density polyethylene proved ideal and further material improvement has resulted from experimental work on this equipment. So far, a 90-gal container and liners for 55-gal steel drums and 40-gal water softener tanks indicate the size range of items that can be molded in this machine.

The blow molder was designed by Williams-White & Co., for the Plastics Corp., Rock Island, Ill.

L.G.S.



## DYNAMIC BALANCING ELIMINATES CLUTCH VIBRATION

*assures you smooth, enduring clutch performance*

Rockford Clutches are vibration free . . . This means your on and off-highway vehicles or industrial machinery get extra-long clutch life, top power from your engines and extremely smooth engagements. Rockford eliminates vibration by dynamically and statically balancing each clutch. Above, a Rockford man spins a clutch on a special balancing machine. He then views electronic scope for vibrational-blips and removes



heavy spots to insure perfect balance. Clutch vibration can ruin bearings . . . crack housings . . . damage crankshafts or other essential components. Consider the operator of your equipment . . . freedom from vibration means quite a bit to him, too. No uncomfortable nerve-jangling work here. Yes, quality construction is Rockford's key to efficient clutch reliability. Rockford offers a wide range of power controls. Write today for illustrated brochure.

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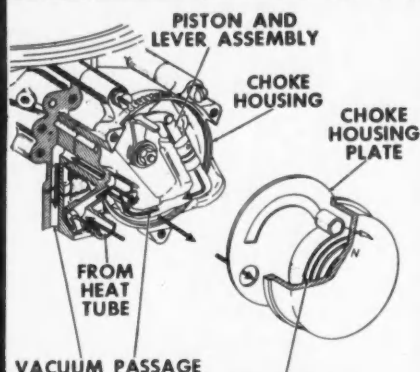


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# Chace THERMOSTATIC BIMETAL

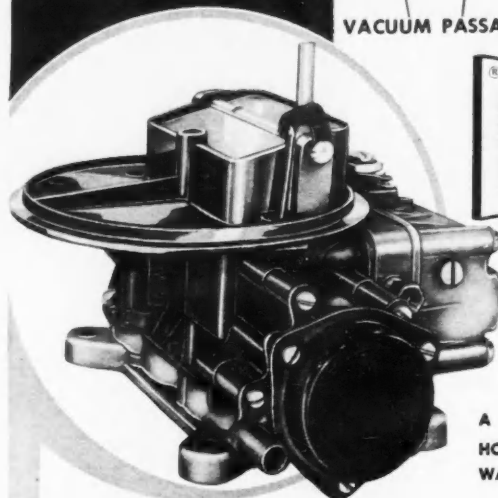
ACTUATES ANOTHER  
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**HOLLEY**  
Carburetor Co.

**AUTOMATIC  
CHOKE**

A product of  
HOLLEY CARBURETOR CO.  
WARREN, MICHIGAN



Cold-weather starts—or non-starts—were once the bane of every motorist's existence. The attendant stalling and loss of power due to cold-impaired carburation are now a thing of the past, thanks to the efficient Holley Automatic Choke. A properly running engine, equipped with the famous Holley Carburetor and Automatic Choke, will start quickly, positively in the coldest weather. Here's how:

The thermostat is a bimetal coil which—when cold—closes the carburetor choke plate to allow a "rich" concentration of fuel to enter the combustion chamber. In starting, manifold vacuum is applied to the piston and lever assembly, which attempts to open the choke plate. The cold bimetal resists this motion, at the same time allowing the choke plate to open slightly; admitting only enough air to keep the engine running. As engine heat is generated, it causes the thermostat coil to relax and open the choke plate further and further till operating temperature is attained, at which time the choke plate is fully open.

The actuating element—"thermostat"—is a coil of precision Chace Thermostatic Bimetal produced to Holley's exact specifications. The result is a device which will perform this important function *every time* the car's engine is started. That's dependability; the dependability Chace has developed in more than a third of a century of specializing in the manufacture of one product: precision Thermostatic Bimetal produced to specifications. Chace Thermostatic Bimetal is known the world over by companies large and small, who know that when they specify Chace, they also specify dependability.

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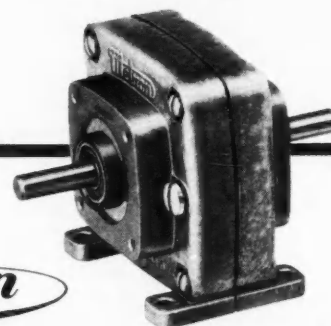
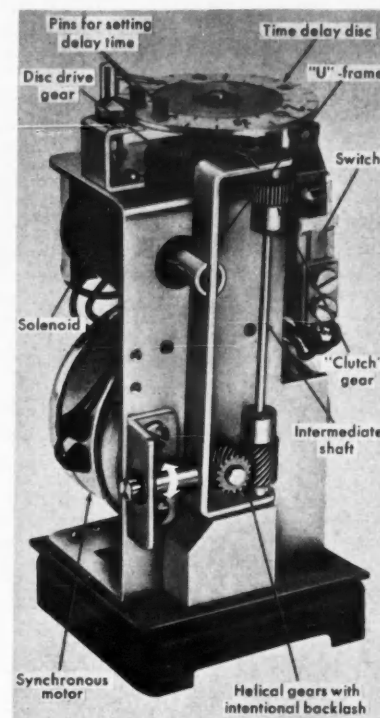
## IDEAS IN THE NEWS

• **INTENTIONAL BACKLASH BETWEEN HELICAL GEARS** in a time-delay relay is utilized for "clutch" action. The resulting system provides reliable performance with few and simple components.

A helical drive gear on the synchronous motor shaft engages a helical gear on the intermediate shaft. Sufficient backlash allows the latter to pivot without binding the gears. When the relay is actuated, a solenoid pulls on the "U" bracket holding the intermediate shaft. As a result, the small "clutch" gear at the upper end of the intermediate shaft engages the drive gear for the time-delayed disc. A return spring disengages the "clutch" gear after the solenoid has been de-energized.

Alkan and Sinay Co., Paris, France, designed and manufactured the unit. G.B.B.

PINS on time-delay disc are set for desired delay between solenoid actuation and switch operation. Motor, solenoid and switch can be connected in various ways to conform with circuit requirements. Time delays between 1 sec and 18 min, depending on gear ratios used, are available with claimed accuracy of 2 percent. Relay measures 2 by 2 by 5 inches.



FROM



## BANTAM SPEED CHANGERS

RATIOS: 646 from 1:1 to 85184:1  
HORSEPOWER: 0.1 maximum  
TORQUE: 130 oz-in  
SPEED: 10,000 RPM maximum  
BACKLASH: 15' maximum (Series 11)  
WEIGHT: 16 to 45 oz depending upon ratio  
BEARINGS: double, heavy-duty ball  
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Bantam speed changers are only one product in Metron's complete line of small speed changing components. Call on our engineers for design help with your speed changing or control problems. Tell us what *results* you're after—what your inputs and loads are. We'll come up with an output package to do the job efficiently and economically. Send your prints today!



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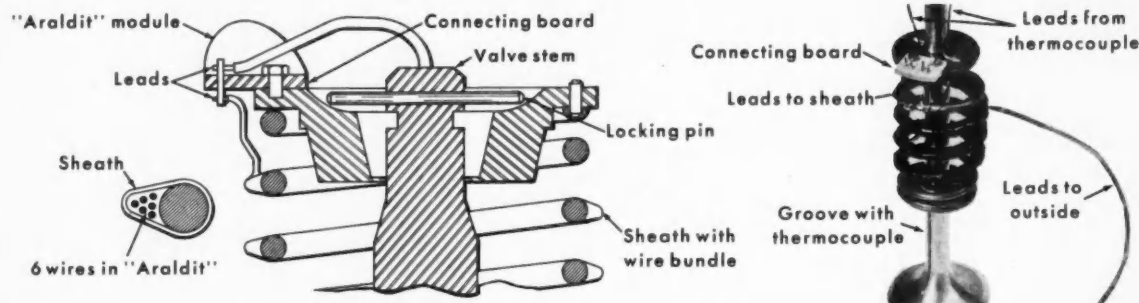
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DESIGN NEWS—JULY 7, 1961

• **ONE-MM OD THERMOCOUPLE** is used in the Daimler-Benz laboratories, Stuttgart-Untertuerkheim, Germany, for measurement of valve temperatures in automotive engines. Thermocouple wires are all chrome-alumel. The heat-resistant steel tubes support the 20.1-mm diameter wires embedded in magnesium oxide. The thermocouple is small enough not to distort normal temperature patterns and strong enough to survive high acceleration in temperatures. Semi-elastic mounting of leads with "Araldit" epoxy binder absorbs the effect of high accelerations on the connecting wires.

The thermocouple is seated in the valve-stem groove, which is partly peened over. Three pins block rotation between stem, spring retainer, spring and spring seat. This reduces wire motion to the small-amplitude torsional movement of the valve spring.

As the top end of an overhead valve stem has a

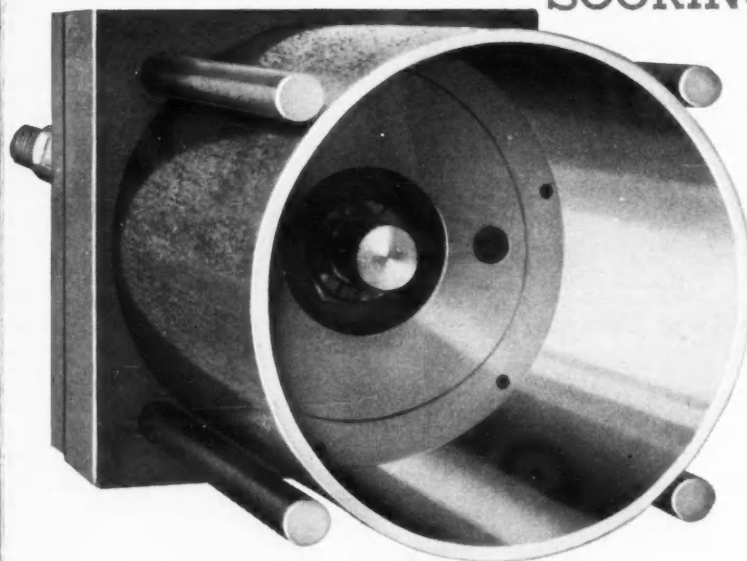


temperature which is neither known nor constant, the cold joint of the thermocouple has to be outside the engine. To avoid repeated and excessive bending of low fatigue-strength thermocouple wires, these are led up to the stem to a small connecting board on the spring retainer. The board has short wire posts of the same thermocouple material, to which both the wires from the thermocouple itself and extension wires to the outside are attached. An epoxy module seals and holds the connections elastically. From the board, extension wires run along the valve spring and out through the cylinder head. The wire bundle is attached to the spring by a shock-absorbing epoxy binder.

The thermocouple was developed by NV Philips, Eindhoven, Netherlands; epoxy binders "Araldit" 121N and 121B are products of CIBA AB, Basel, Switzerland.

R.F.S.

## SCORING RESISTANCE...



and cylinder life are increased by new chrome-plated barrel ID's on Hydro-Line Series R2 cylinders. Hard chrome-plating resists scoring, even under critical side loads. Corrosion is eliminated, even where condensation is unusually severe.

Laboratory endurance tests proved to us that these chrome-plated barrels designed into heavy-duty cylinder applications will decrease machine downtime and maintenance costs.

Standard on Series R2 air cylinders to 200 psi; hydraulic cylinders to 2500 psi; bore sizes from 1½" to 12" all ready for immediate delivery. See your Hydro-Line representative for details.



5603 PIKE ROAD, ROCKFORD, ILLINOIS, manufacturers of: high- and low-pressure hydraulic cylinders • heavy-duty air cylinders • boosters • adjustable-stroke cylinders • dispensing cylinders • single-acting cylinders • rod end couplers

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DESIGN NEWS—JULY 7, 1961

## DESIGN BIG VALVE CAPACITY.....INTO SMALL SPACE



Available:  
2-3-4 Way  
¼" and ½" Sizes  
Dead Seal—  
No lubrication  
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Model 250-4E2  
¼" 4-Way  
Momentary Contact

## New! Humphrey ELECTRIC VALVES

### SPECIFICATIONS

(¼"-4 Way)

Pressure Range—30-125 PSI

Orifice Size—.250

Shipping Weight—3 lb. 4 oz.

Dimensions—4-5/16" x 4-1/4" x 2-3/8"

80.04 C.F.M. @ 100 PSI

### EXCLUSIVE ELECTROPACT DESIGN

Coils—Epoxy Sealed, Metal Encased

Stroke (Sol.)—.022 Full

#250-4E2 Momentary Contact	#250-4E1 Maintained Contact
Voltage 115V 60 cycle	
Inrush 0.165	0.340
Hold 0.136	0.256
Other voltages available	

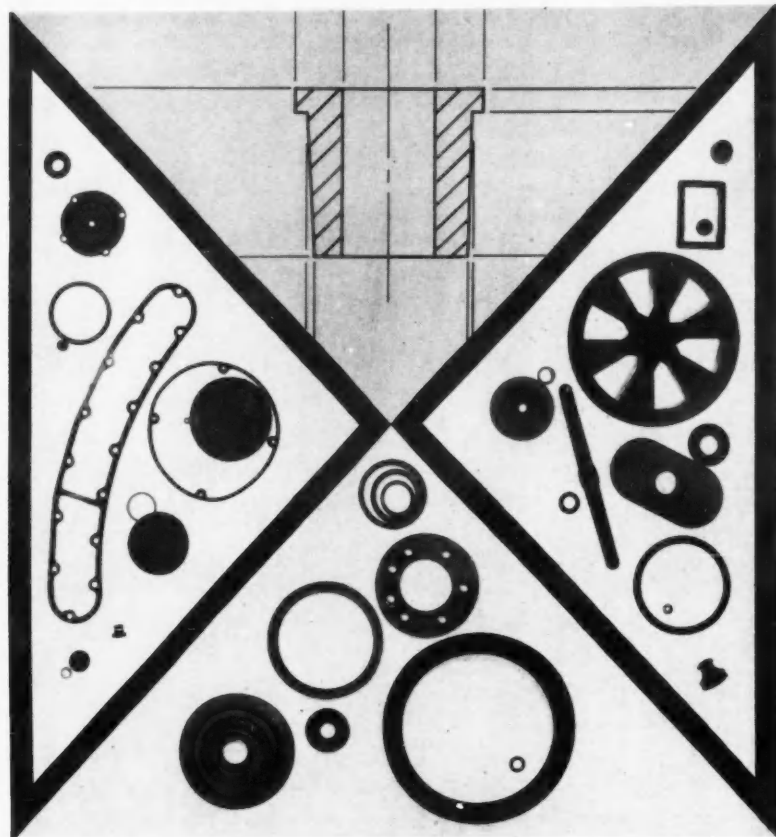
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## IDEAS IN THE NEWS

• **IN-CORE, THERMAL NEUTRON FLUX MONITORING SYSTEM** is included among the safety systems of the Dresden Nuclear Power Station. There are 16 assemblies, evenly distributed in the core of the reactor. Each assembly has four detectors which are positioned respectively on four horizontal planes in the core.

The assemblies are exposed to boiling water at 1000 psi pressure and 543F temperature. The overall length of the assemblies exceeds 31 ft, yet each detector is relatively small, 1/4 inch OD by 2-1/4 inches long. Coaxial cable connects cable termination fitting to in-core ion chamber. Both the sheath and center conductor of the cable are 304 stainless steel. Its OD is 1/8 inch. Aluminum oxide is the insulation material.

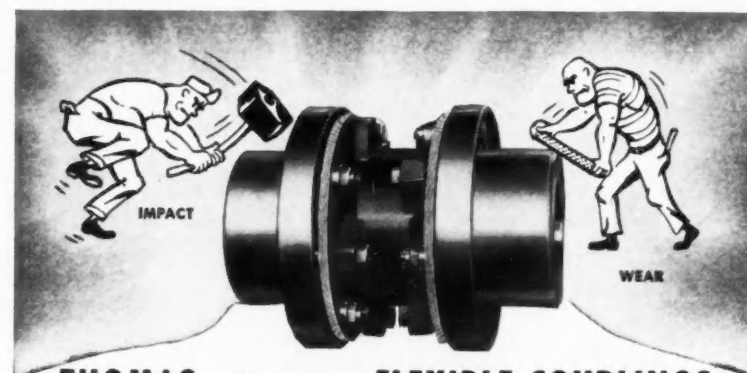
Neutron sensitivity is provided by a uranium-aluminum alloy sleeve. With the

uranium content of the alloy fixed, the sensitivity of the chamber is a function only of the dimensions of the chamber and the gas pressure. The sensitivity is independent of variations in the sleeve thickness as the layer is infinitely thick to fission products.

Fuel rod closure welds join the major diameter of the detector to the upper end fitting and to the lower end evacuation tube. The stepped joint construction provides a symmetrical heat path from the joint. The taper between the evacuation tube and the major diameter of the detector provides a smooth transition to minimize possibility of the assembly snagging during its insertion or withdrawal.

The In-Core Ion Chamber is a design development of Atomic Power Equipment Dept., General Electric Co., San Jose, Calif.

E.W.S.



### THOMAS "All Metal" FLEXIBLE COUPLINGS Have No Wearing Parts - Withstand Impact

For brute strength, reliability and protection of your machines Thomas Flexible Couplings, with their inherently correct principle, have never been excelled. Over forty years of manufacturing couplings exclusively, based on this principle, assure a lifetime of dependable service.

**UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:**

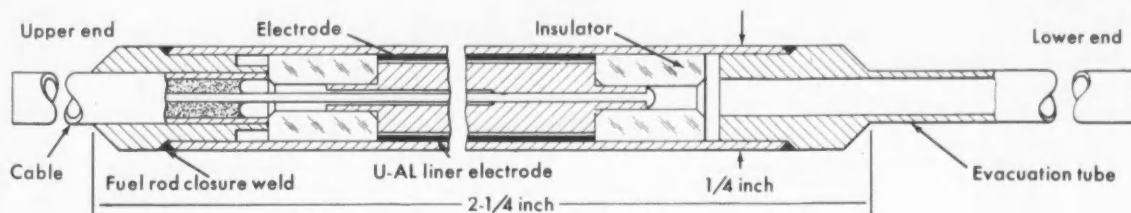
- Freedom from Backlash
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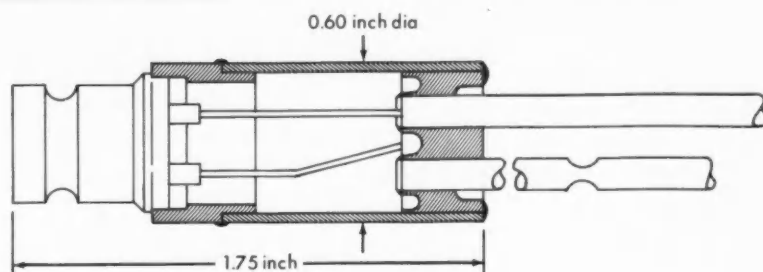
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DESIGN NEWS—JULY 7, 1961



ION CHAMBER has active length of one inch. Ion collection volume is gas volume between inner cylinder and outer shell between two end insulators. Neutron sensitivity is provided by 0.007-inch uranium-aluminum alloy sleeve in chamber. Sleeve is formed from alloy ingot with 17 percent fully enriched uranium by weight. Cast alloy is turned to final OD dimension and pressed into outer cylinder. ID is then reamed to finished size. After welding, detector is evacuated through tube and pressurized with dry nitrogen gas before closing off tube.

IN-CORE ION CHAMBER has voltage applied to center conductor of cable which connects to center electrode of chamber. Signal is detected as voltage drop across precision resistor in high-voltage lead. Ballast resistor is included in each of high-voltage leads to individual chamber. In case of shorting of one cable or one chamber, operation of remaining detectors is not affected.



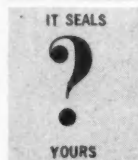
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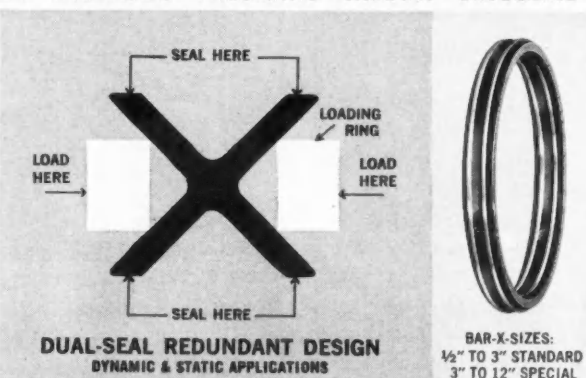
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YOURS



VACUUM SYSTEMS



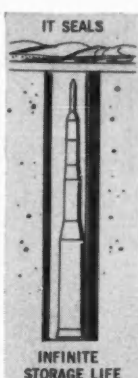
DUAL-SEAL REDUNDANT DESIGN  
DYNAMIC & STATIC APPLICATIONS



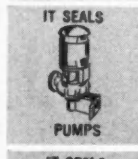
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SPACE ENVIRONMENTS



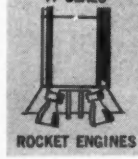
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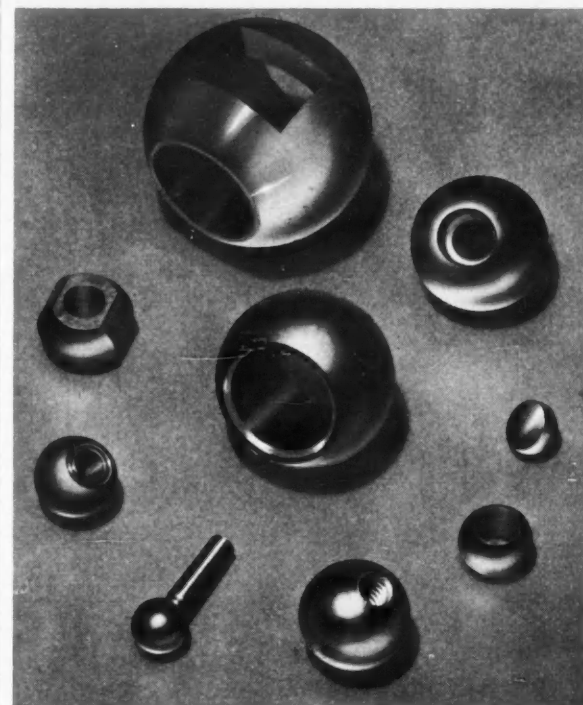


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Circle 66 on Reader-Service Card for more information

# MARVEL Synclinal FILTERS

FOR DEPENDABLE PROTECTION on all HYDRAULIC and other low pressure circulating systems



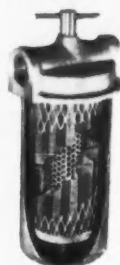
## Synclinal Sump Type

**Capacities:**  
5—8—10—20—30—50—75  
and 100 G.P.M.

**Pipe Sizes:**  
3/4"—1"—1 1/4"—1 1/2"—  
2"—2 1/2" and 3".

**Connections:**  
Coupling—Male Nipple.

**By-pass Valve:**  
Not Available.



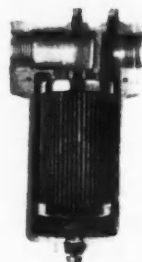
## Synclinal Line Type

**Capacities:**  
5—8—10—20—30—50—75  
and 100 G.P.M.

**Pipe Sizes:**  
3/4"—1"—1 1/4"—1 1/2"—  
2"—2 1/2" and 3".

**By-pass Valve:**  
Not available.

**Operating Pressures:**  
Up to 80 p.s.i.



## Bonded Line Type

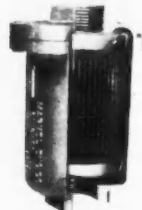
**Capacities:**  
10—20—30—50 and  
75 G.P.M.

**Pipe Sizes:**  
1"—1 1/4"—1 1/2"—2"  
and 2 1/2".

**By-pass Valve:**  
Available with or without.

**Operating Pressure:**  
Up to 250 p.s.i.

**Operating  
Temperatures:**  
Up to 300° F.



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**Capacities:**  
Up to 60 G.P.M.

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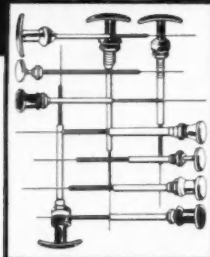


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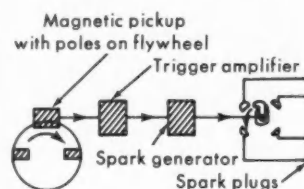
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## IDEAS IN THE NEWS

• **HIGH-TENSION VOLT-AGE** in a new automobile ignition system developed for racing purposes is produced by an electronic circuit. Basically, the system comprises an electromagnetic pickup associated with pole pieces attached to the engine flywheel, a trigger amplifier, a spark amplifier, a spark generator and a distributor.

As the engine rotates, volt-



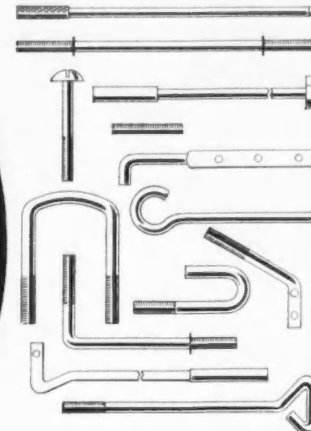
age pulse is produced at the pickup each time one of the pole pieces passes within its field. This pulse is applied to the trigger amplifier, allowing current to flow through the primary windings of a trigger transformer. The voltage pulse results in this "switch" opening so that current flow through the primary ceases.

Energy, released by the resulting current collapse, induces a voltage in the trigger transformer secondary winding. This, in turn, causes a current to flow in the base circuit of the spark generator. An associated transistor thereby becomes conducting, so that current flows in the primary winding of a high-voltage transformer. A regenerative oscillation is initiated, resulting in a rapid increase in primary current. This gives rise to an induced voltage in the transformer secondary winding of over 20 kv which is applied to a distributor rotor arm.

Regeneration ceases when the transformer is saturated

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## MORE DESIGN FREEDOM

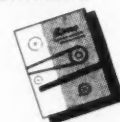
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transfer  
without  
complicated  
gearing...

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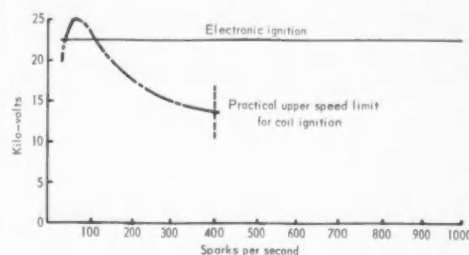
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COMPARISON OF SPARKING PERFORMANCE BETWEEN ELECTRONIC IGNITION SYSTEM AND CONVENTIONAL COIL IGNITION

and the transistor again becomes nonconducting. The complete regeneration cycle lasts less than 200  $\mu$ sec. With the cessation of the voltage pulses at the pickup, conduction again commences in the trigger amplifier circuit in readiness for repetition of the cycle at the next pickup pulse.

Developed by Joseph Lucas, Ltd., Birmingham, England, the new system can provide a spark rate equivalent to an eight-cylinder engine running at 15,000 rpm.

R.W.E.M.

## **Meetings**

Pacific Palisades,  
Calif., Aug. 2-4

SUMMER MEETING ON AEROSPACE APPLICATIONS FOR HYDRAULIC FLUIDS TEST METHODS, American Society for Testing Materials, Santa Ynez Inn.

Portland, Ore.  
Aug. 14-17

NATIONAL WEST COAST MEETING, Society of Automotive Engineers, Sheraton Hotel.

Ann Arbor, Mich.  
Aug. 15-17

CRYOGENIC ENGINEERING CONFERENCE, University of Michigan.

Cambridge, Mass.  
Aug. 21-23

INTERNATIONAL HYPERSONICS CONFERENCE, American Rocket Society, Massachusetts Institute of Technology.

San Francisco, Calif.  
Aug. 22-25

WESTERN ELECTRONICS SHOW AND CONFERENCE, Cow Palace.

Raleigh, N.C.  
Sept. 6-8

JOINT NUCLEAR INSTRUMENTATION SYMPOSIUM, Institute of Radio Engineers, Institute of Electrical Engineers and Instrument Society of America, North Carolina State College.

Los Angeles, Calif.  
Sept. 6-8

ANNUAL MEETING, Association for Computing Machinery, Statler Hilton Hotel.

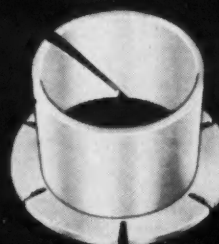


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# THE ANATOMY

## OF AN MF TWO-WAY LOCK NUT

reveals why it can improve your product and simplify fastening

### DOUBLE CHAMFER...

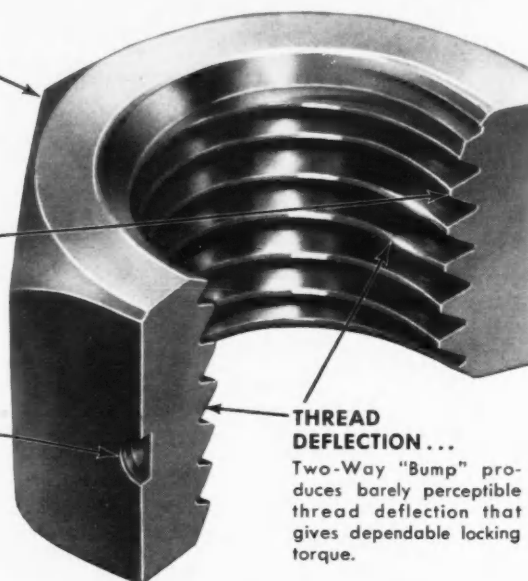
The Two-Way is always right side up. Ideal for hand or hopper feed.

### THREAD PROFILE...

More care in tapping produces threads that far exceed industry's minimal standards.

### THE "BUMP"...

Puts the lock in the center of the nut. Does not affect top and bottom threads—permits easy starts. Allows bolt end to be flush with, or below, top of nut.



### THREAD DEFLECTION...

Two-Way "Bump" produces barely perceptible thread deflection that gives dependable locking torque.

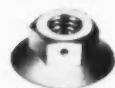
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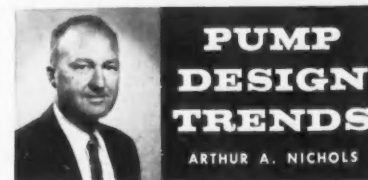
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### NEW BUILT-IN PUMP PERFORMS WELL UNDER VARIABLE CONDITIONS

► The development of three matched Gerotor pump elements that can be designed right into any mechanism requiring a pumping function, offers important design and performance advantages.

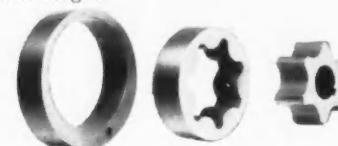


Fig. 1. Three Gerotor components permit pump to be incorporated as integral part of housing or frame of mechanism, eliminate need for purchase and mounting of separate, complete pump.

► The Gerotor pump is a positive displacement type, delivering a predetermined amount of fluid in direct proportion to speed. It is a form of internal gear pump — simple and compact in basic design, (has only two moving parts). It is lightweight, valveless, provides exceptional performance and has low wear over a long service life. It is balanced and extremely quiet in operation.

► Low relative speed and closely held clearances between the two Gerotor elements maintain high mechanical and volumetric efficiency.

► Slow opening of the chamber as it traverses the large inlet and discharge ports results in avoidance of the sudden shock, rapid pressure change and turbulence which, in other types of pumps, results in foaming and lowered efficiency. Thus, Gerotor pumps offer exceptionally good performance over a wide range of inlet pressures.

► Gerotor Insert-Packages can be designed and mass-produced to deliver up to 100 gpm and 1,000 psi within a wide range of mechanism geometry. That's because Gerotor pump capacity is a function of diameter, thickness, number of teeth and rpm of the two moving parts. These variables can be matched to just about any space restriction and capacity requirement.

► Technical data is available. Write:

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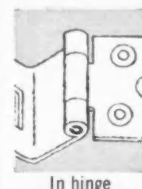
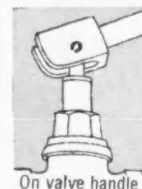
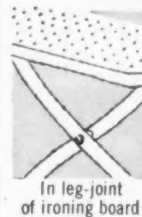
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West Coast Division: Huntington Park, California  
Southwest Division: Garland (Dallas County), Texas



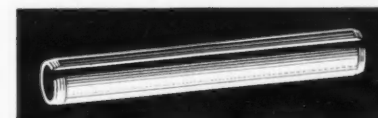
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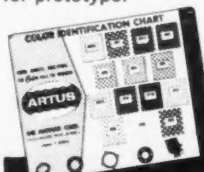


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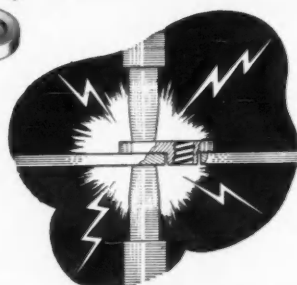
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**SN NUT**  
Thread Sizes  
#6-32 to  
3/8-16



**ND NUT**  
Thread Sizes  
#6-32 to 3/8-16



**SS SCREW**  
Thread Sizes  
#6-32 to  
3/8-16

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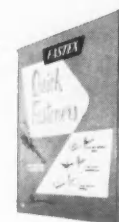


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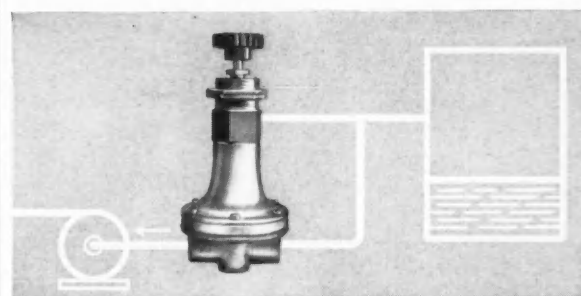


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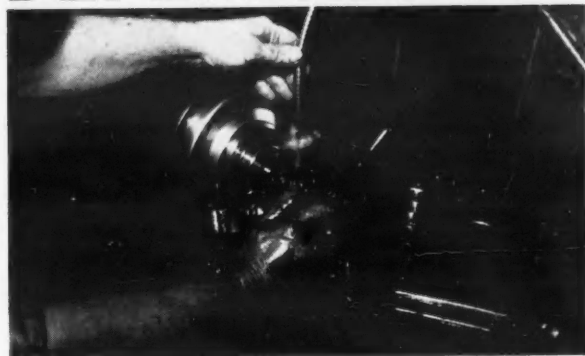


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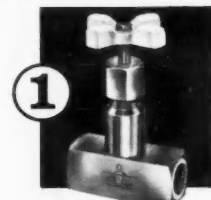
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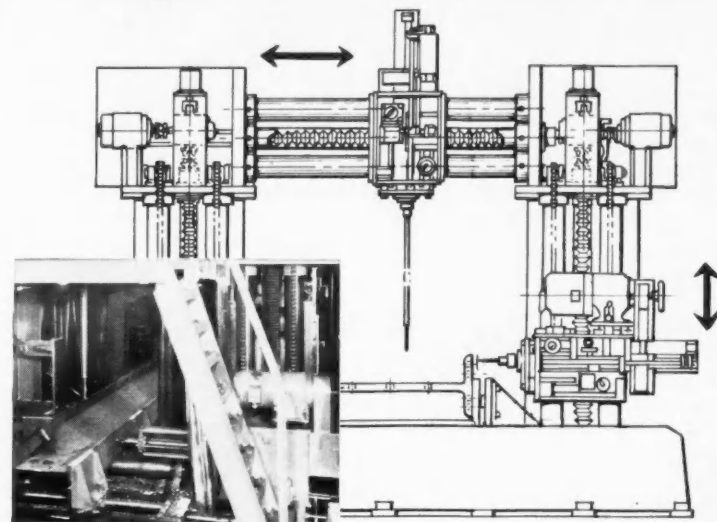
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416 STAINLESS STEEL

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## Beaver Ball Screws help Mahon save 85% in drilling holes in bridge beams, columns

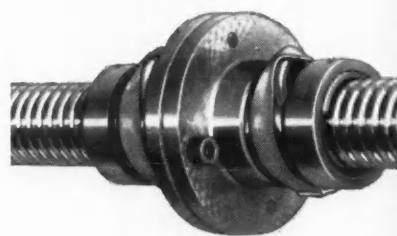


Close tolerance positioning of massive 1½" capacity vertical and horizontal drill heads is accomplished with Beaver ground-thread ball screws in this new, numerically controlled drilling machine, first in the structural steel industry.

Walter P. Hill, Inc., designed and built the machine for The R. C. Mahon Co., Structural Steel Division

In addition to the important drilling cost savings, it offers repeatability in hole pattern accuracy within  $\pm .005$ " as compared with  $\pm \frac{1}{8}$ " by conventional methods and eliminates costly hole reaming in final assembly.

*If you are considering data control, Beaver ball screws will give you the power efficiency, positioning control and compactness you need. Our engineers will be glad to work with you just as they did, in this case, with the Walter P. Hill designers.*



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The new single unitized housing construction on Heinze D Sub-Fractional Horsepower Blowers provides more rugged durability; more efficient air delivery; reduced service costs; and a lower selling price due to lower manufacturing costs.

Housing is CRS with baked enamel finish. Blower is stronger for rough usage — yet inner assembly is easily accessible for servicing.

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## PLANS AND CROSS-SECTIONS

### Show Me the Way to Go Home!

The ancient mystery of how homing pigeons manage to navigate over unfamiliar territory and find their way home has attracted Navy interest.

The Office of Naval Research is using a new system that makes it possible, for the first time, to track a pigeon during the entire flight. The equipment got its first trial when a pigeon was tracked during a 20-mile jaunt to its home in the Philadelphia area. It carried a tiny powerful radio transmitter, weighing less than an ounce, on its back. Attached to the transmitter was a 40-inch antenna, trailing behind the bird and partially encased in a glass fiber rod.



A beacon receiver designed to operate with the transmitter can pick up the signal from any direction over a 20-mile range. Two receiving stations were set up along the probable flight path to record directional information at exact predetermined time intervals. American Electronic Laboratories developed the system for the Navy.

### Shock Treatment Changes Graphite's Personality

Diamonds have been formed artificially by an explosive shock moving through a tiny pile of graphite.

Although not the ring type, the diamonds were still the first ever produced by a shock wave. The black diamonds sprang into existence when a 1-lb explosive charge was set off, driving a split-second shock wave into a graphite container with a force of about 3,000,000 psi.

Purpose of the experiment was "to study the effects of explosive shocks on

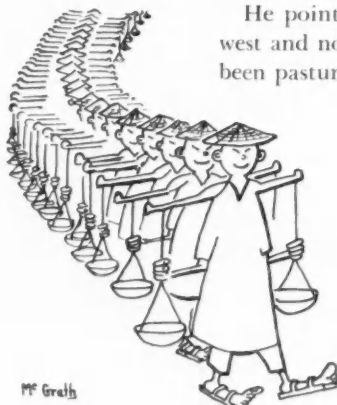
various minerals", but the experimenters, Dr. P. S. DeCarli of the Stanford Research Institute and Dr. J. C. Jamieson of the University of Chicago, do not overlook the fact that this may be a new way of creating man-made industrial diamonds. The experiments also unintentionally demonstrated that diamonds found in some meteorites could have formed under high pressure when a meteorite slams into the earth.

**Busy,  
Busy,  
Busy!**

To counteract floods and erosion, the Chinese claim to have built 15,000,000 dams, drilled 41,000,000 wells and moved enough dirt and sand to build 450,000,000 Panama Canals since 1952. "If only one-tenth of this is true, it is still a fantastic figure," according to Dr. G. Borgstrom of Michigan State University.

He pointed out that millions of Chinese have been moved to west and northwest China, Tibet and Sinkiang on land that had been pasture for thousands of years.

"It is likely," he said, "that the Chinese used this manpower to build dams and plow pasture. If they did, evaporation and moisture demands of new crops could have resulted in a loss of water downstream." Dr. Borgstrom noted that the severe food shortage the Chinese blame on natural disasters could well be aided by a somewhat misguided policy on technological advances.

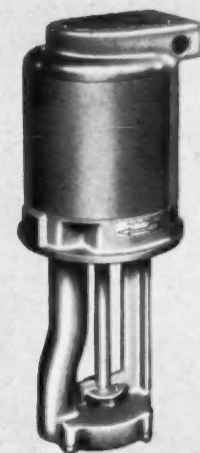


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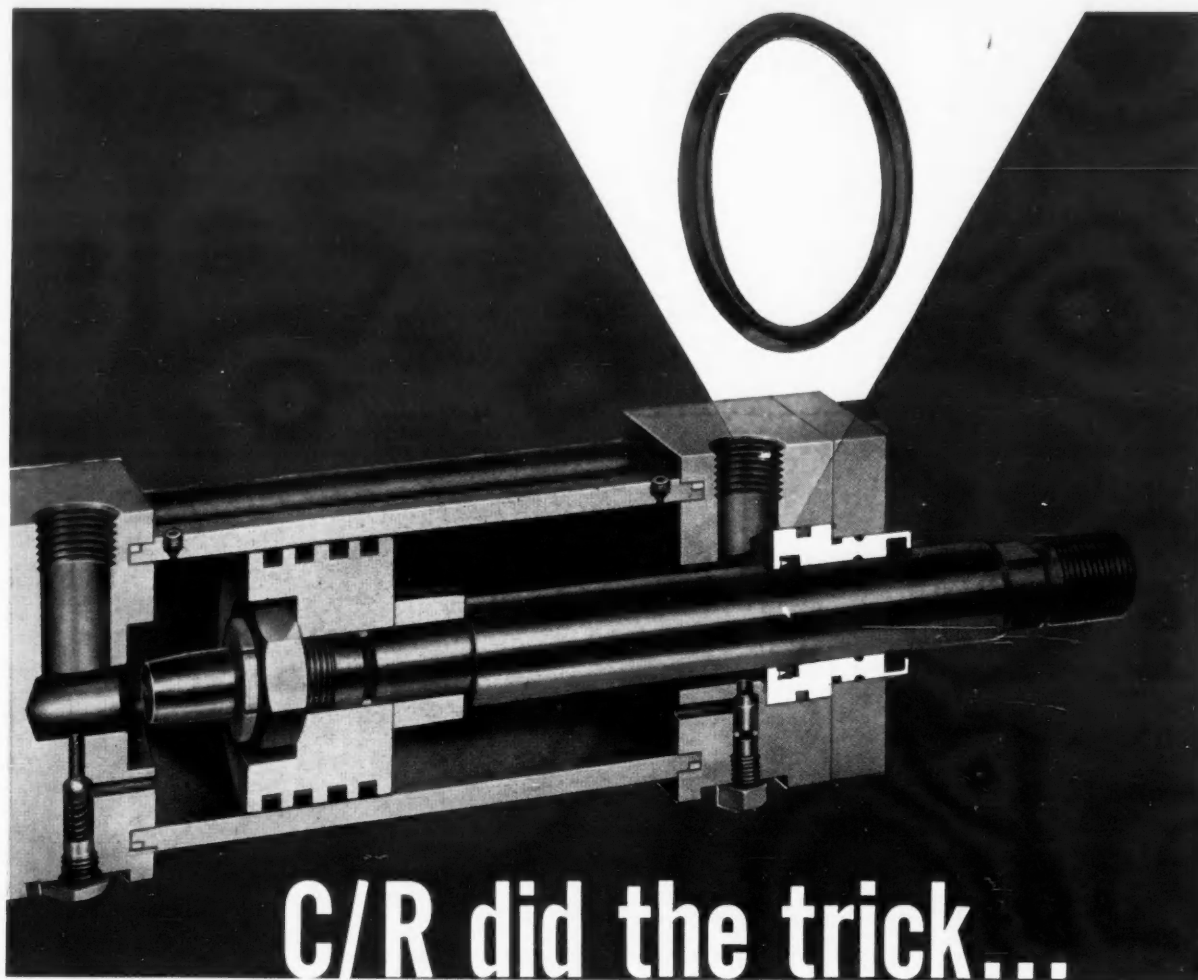
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